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Evaluation of statistics teaching practices: Development of a two-structure observation form

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ABSTRACT

Teachers' instructional practices play a crucial role in students' understanding and application of statistical concepts. This study aimed to design an observation form to evaluate the quality of statistics teaching in classrooms. The form was developed around two key structures emphasized in the literature: statistical knowledge for teaching and the statistical process. Statistical knowledge for teaching was addressed in five components (knowledge of content and students, knowledge of content and teaching, curriculum knowledge, key developmental understandings, and pedagogically powerful ideas). The statistical process was represented through four components (formulating statistical investigative questions, data collection, data analysis/representation, and interpret the results). The development of the form followed a three-phase process: preparation, implementation, and evaluation. In the preparation phase, relevant models and reports were reviewed, and a draft form was created based on expert feedback. In the implementation phase, the form was tested in two stages: a preliminary review of its aspects and a classroom application involving six hours of lessons covering all stages of the statistical process. Finally, in the evaluation phase, the form was revised and finalized. The results indicated that the form demonstrated both validity and usability. It is expected to serve as a valuable tool for future research on statistics education.

KEYWORDS: Observation form; Statistical knowledge for teaching; Statistical process

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1. Introduction

It is stated that statistics are increasingly evident in every aspect of our daily lives (Bargagliotti et al., 2020). In our society, which is in constant interaction with data (Engledowl & Tarr, 2020), there is a need to make effective data-driven decisions to keep pace with technological developments (Rodrigues & Ponte, 2020). In parallel with this need, training individuals equipped with statistical knowledge emerges as an important goal. In particular, the GAISE (Aliaga et al., 2005; Bargagliotti et al., 2020; Carver et al., 2016; Franklin et al., 2007) and SET (Franklin et al., 2015) reports list principles based on contemporary approaches for teaching statistics, and draw attention to the fact that training individuals who are equipped in terms of statistics and can transfer statistical knowledge to their lives is now an inevitable need.

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Considering the role and importance of statistics in our lives, there has been an increasing emphasis on improving the quality and quantity of statistics teaching practices in recent years (Batanero et al., 2011; Meletiou-Mavrotheris & Serradó, 2011; Pfannkuch & Ben-Zvi, 2011). Students are expected to be equipped with statistical knowledge and to have basic literacy skills for situations in their lives (Watson, 2006). While various factors are mentioned that affect students' development as individuals equipped in the field of statistics (Sproesser et al., 2014), it is emphasized that one of these factors is teachers (González et al., 2011). At this point, among the searches for learning opportunities offered to students, the question of what kinds of experiences they have in statistics education also becomes meaningful. Drawing attention to the importance of developing statistical knowledge and understanding in individuals also brings into focus questions about the quality of statistics education. In this context, there is a need not only for students but also for teachers to possess the necessary knowledge and skills to deliver more effective statistics instruction. Therefore, the role of teachers in the learning environment is directly related to the practices and approaches they include in their teaching.

It is recommended that statistics teaching should focus on statistical literacy and thinking, that real-life data should be used, that the statistical process should be experienced with active participation in the form of collect data, data organization, data analysis-representation and interpretation rather than the application of rules, formulas and procedures, and that conceptual understanding development in students should be ensured (Aliaga et al., 2005; Carver et al., 2016). In addition, studies have highlighted the importance of teachers considering the statistical process stages as a whole, which include creating statistical research questions, collecting data/evaluation, data analysis, and interpreting the results during the teaching process (Bargagliotti et al., 2020; Newton et al., 2011; Özmen, 2015). In addition, it is stated that teachers see themselves as inadequate and do not have the necessary equipment for teaching statistics (Batanero et al., 2011; Batanero et al., 2004; Gattuso & Ottaviani, 2011; Hill et al., 2004; Lovett & Lee, 2017; Wessels, 2011; Yeniçırak, 2020) and do not graduate from universities prepared and equipped for teaching statistics (Henriques & Ponte, 2014; Koparan, 2015; MacGillivray & Pereira-Mendoza, 2011; Yılmaz, 2019). International literature indicates that students' and teachers' statistical knowledge is not at the expected level and needs improvement (Callingham & Watson, 2017). Similarly, in the national literature, it is noted that teachers do not have sufficient knowledge about teaching statistics, that they have difficulties in teaching statistics subjects (Kaynar & Halat, 2012; Koparan, 2015; Ulusoy & Çakıroğlu, 2013; Yeniçırak, 2020), and that teachers need to enrich their statistics teaching (Akkoç & Yeşildere-İmre, 2015; Gürel, 2016; Koparan, 2015; Yılmaz, 2019).

The development of teachers' statistical knowledge and skills and the enrichment of statistics teaching with the statistical knowledge and skills required by the age are important initiatives, and it is noted that as a natural result of such an initiative, students' statistical knowledge and skills will also improve (Callingham et al., 2016; Callingham & Watson, 2017; Hay, 2010; Pierce & Chick, 2013; Yeniçırak, 2020). It is stated that students have various difficulties regarding statistics topics and concepts (Tishkovskaya & Lancaster, 2012; Zakari, 2020; Zieffler et al., 2008). It is thought that there is a strong connection between students' ability to overcome these difficulties and the teaching carried out by teachers. At this point, it is worth examining teachers' practices in teaching statistics. In other words, it is considered important how teachers' statistics teaching practices are in terms of the teaching recommendations and approaches that will add quality to statistics teaching expressed in the GAISE (Aliaga et al., 2005; Bargagliotti et al., 2020; Carver et al., 2016; Franklin et al., 2007) and SET (Franklin et al., 2015) reports, which are considered important in statistics teaching, what they do

to overcome student difficulties, and what kind of teaching they do in terms of statistical process and statistical knowledge for teaching. Therefore, it is important to examine teachers' statistical teaching practices in terms of the teaching strategies and knowledge-skills outlined in reforms and reports on statistics education.

When the literature on statistics and statistics teaching is examined, it is seen that studies on statistics and statistics teaching have been conducted to reveal theoretical frameworks related to the knowledge of teaching statistics (Burgess, 2006; 2007; Burrill & Pfannkuch, 2024; Godino et al., 2008; Godino et al., 2011; González, 2014; Groth, 2007; 2013; Silverman & Thompson, 2008), to improve teachers' knowledge of teaching statistics (Baker & Chick, 2006; Lee & Hollebrands, 2011; Souza et al., 2015; Wright et al., 2024), examining teachers' understanding of certain statistical concepts (mean, graph reading, change) (Callingham & Watson, 2011; González et al., 2011; Jacobbe & Carvalho, 2011; Sanchez et al., 2011; Watson et al., 2009), and determining teachers' and prospective teachers' knowledge of teaching statistics (Batur, 2021; Forgasz et al., 2024; Yılmaz, 2019). However, few studies have addressed the practicalities of teaching statistics to teachers. In these studies, it is generally seen that teaching practices are addressed in specific contexts such as examining the courses in terms of statistical/graph literacy, which is considered as the target for statistics teaching (Özmen, 2015; Uyanık, 2022), experiencing instructional practices related to the statistical process (Güven et al., 2015), and examining statistics teaching by focusing on the dimension of knowledge of teaching a particular statistic (Yeniçırak, 2020). On the other hand, studies on the stages of the statistical process, which range from the formulation of statistical research questions to the interpretation of results, are very limited (Pfannkuch, 2005). It is evident that in statistics teaching practices, statistical knowledge for teaching and the stages of the statistical process come to the fore. It is important to consider these two dimensions together, as they play complementary roles in achieving the ultimate goal of developing statistics education. In addition, there is a need to evaluate teachers' classroom practices in line with current approaches and suggestions in terms of statistics education. In this context, it is important to consider classroom teaching practices in terms of these two ideas, which are considered important in the curriculum for the development of statistics education. Upon examining the literature, the need to develop a structure that includes the components necessary to evaluate and develop teaching practices for statistics topics and concepts becomes apparent. In this sense, the need to develop an observation form to evaluate teachers' teaching practices in terms of two important structures for statistics teaching constitutes the scope of this study. In this context, the current study aimed to develop a structured observation form to evaluate the statistics teaching practices of secondary school mathematics teachers in terms of statistics teaching knowledge and the stages of the statistical process.

1.1. Theoretical Framework

1.1.1. Statistical Knowledge for Teaching

Statistical knowledge for teaching includes various information and components regarding how best to teach statistics (Groth, 2013). In this context, various models grounded in mathematics education have been proposed by researchers for teaching statistics, which cannot be considered completely independent of mathematics (Groth, 2007; 2013). Groth (2013), considering that the nature of mathematics and statistics is different, presented the statistical knowledge for teaching model and included the knowledge of content and teaching, content and student recognition knowledge, and curriculum knowledge components in the mathematics teaching knowledge models (Baki, 2012; Ball et al., 2008). The components in the model are presented in Figure 1.

Figure 1 ***Statistical knowledge for teaching model***

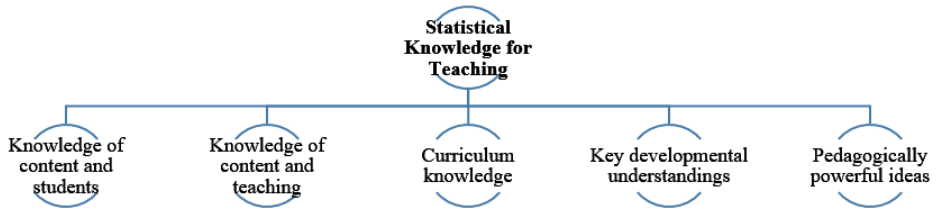


Figure source: (Groth, 2013)

When Figure 1 is examined, five components in the Groth (2013) model stand out. Knowledge of content and students includes information on organizing instruction to take into account students' understanding, possible errors, and misconceptions in statistics teaching, as well as on directing the flow of the instructional process in line with students' answers. Information on how to plan for more effective teaching of statistics subjects and learning outcomes is an important part of content and teaching knowledge. Curriculum knowledge includes information on subjects and learning outcomes related to statistics in the mathematics curriculum, and information on the grade level and order in which the subjects should be taught, taking into account the student level. Key developmental understandings are a component added to Groth's (2013) model of knowledge for teaching statistics and include the basic information needed to make sense of statistical knowledge. This information is presented as an important turning point for gaining knowledge and understanding of the field of statistics and its context. Groth (2013) states this component as an important mechanism in the development of field knowledge and defining cognitive substructures. For example, understanding the idea of "change" is important for understanding measures of spread such as standard deviation. Meanings related to change form the basis for understanding this concept. Finally, pedagogically powerful ideas refer to the activation of situations that support students' understanding of statistics-related information. Groth (2013) states that this component is also an element that will activate key developmental understandings. This component emphasizes providing in-depth understanding and explanations regarding statistical knowledge. For example, deciding which questions to ask students to understand a concept and explaining the answers from the most basic to the most advanced are important elements of this component. The Groth (2013) model is based on the idea that mathematics and statistics are inherently different fields and is developed as a synthesis of mathematics teaching knowledge models (Baki, 2012; Ball et al., 2008) that are frequently used in the literature. In the models of knowledge of teaching mathematics, Groth (2013) included the components of content and teaching knowledge, content and student knowledge, and curriculum knowledge. However, given the nature of statistics, it also included key developmental understandings and pedagogically powerful ideas prominent in the statistics education literature. In this study, which aims to evaluate teachers' statistics teaching practices, the Growth (2013) model was chosen to structure statistical knowledge for teaching, as it includes the theoretical framework related to mathematics teaching knowledge models and incorporates components suited to the nature of statistics.

1.1.2. Statistical Process

The statistical process is holistic, beginning with the formulation of a research question and continuing through the interpretation of the results. In the GAISE-I and II reports (Bargagliotti et al., 2020; Franklin et al., 2007), which include important instructional recommendations for teaching statistics, the statistical process is also expressed as a problem-solving process. The stages of the statistical process are schematized in Figure 2:

Figure 2 ***Statistical process stages***

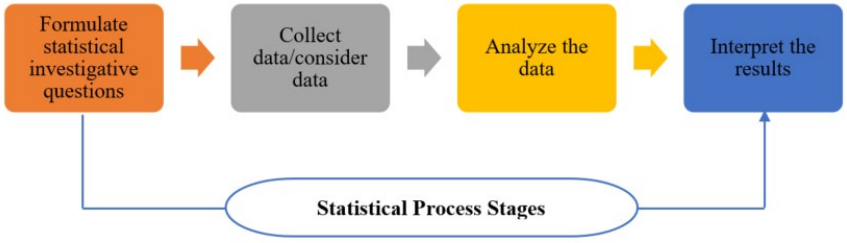
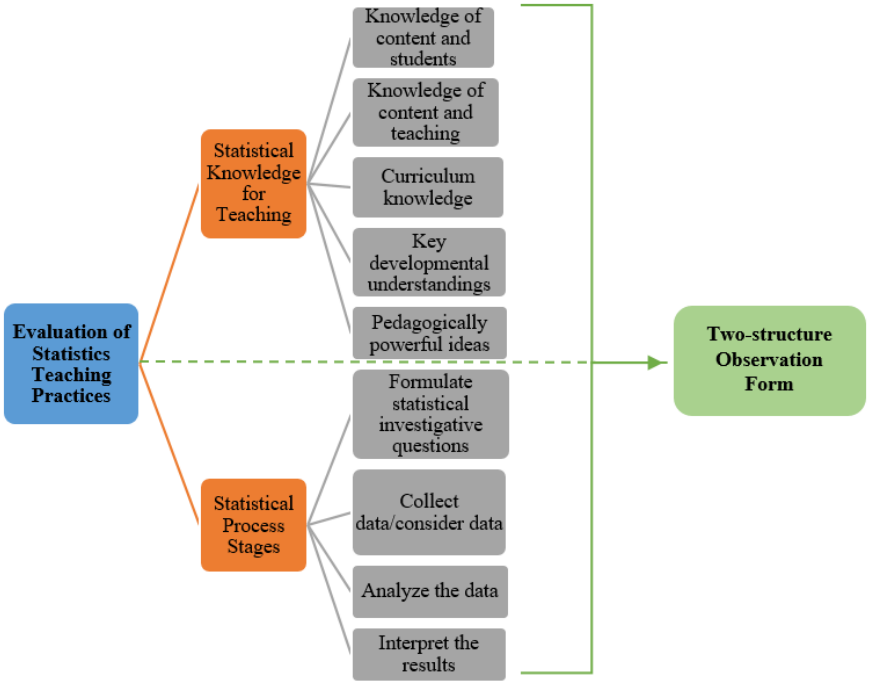


Figure source: (Bargagliotti et al., 2020)

When Figure 2 is examined, the statistical process in GAISE reports (Bargagliotti et al., 2020; Franklin et al., 2007) is explained in 4 stages: formulate statistical investigative questions, collect data/evaluation, analyze the data, and interpret the results. The first of these stages is to formulate statistical investigative questions. The statistical process will be shaped in line with these research questions. In this sense, the question/problem to be posed must have the characteristics of a statistical research question. Data collection/evaluation is the stage where data appropriate to the determined research question are collected. At this stage, it is necessary to select a population/sample that can answer the research question, determine the data collection methods, and collect and evaluate the data. Analyze the data is the stage where appropriate analysis methods and representation types are determined for the collected data. Analyzing the data involves organizing and classifying the collected data, displaying it using various representations (graphs, tables, etc.), and using measures of central tendency (arithmetic mean, median, mode) and dispersion (range, interquartile range, standard deviation, etc.) to summarize it. Interpreting the results is the stage where a decision is made by analyzing the data, taking into account variability, and relating it to its context.

In this study, two theoretical structures (statistical knowledge for teaching and statistical process) were used as a basis for determining teaching practices related to statistics, and this theoretical structure was schematized as in Figure 3 for the observation form developed.

Figure 3*: Two theoretical structures in the evaluation of statistics teaching practices*



When Figure 3 is examined, two structured theoretical frameworks are evident, based on the observation form prepared to evaluate teachers' statistical teaching practices. In this context, the statistical process stages, which are emphasized in GAISE reports (Bargagliotti et al., 2020; Franklin et al., 2007) and highlighted as an important approach for statistics teaching (Güven et al., 2015; Newton et al., 2011; Topan, 2023), played an active role in the creation of the observation form that will be the basis for the evaluation of teaching.

2. Method

In the preparation of the observation form to be developed for the evaluation of statistics teaching, two theoretical constructs, the components of knowledge of teaching statistics and the stages of the statistical process, were taken as the basis.

2.1. Construct Validity of the Observation Form

To evaluate statistics teaching practices, an observation form was developed to capture two important structures emphasized in prominent models and reports in the literature: statistical knowledge for teaching (Groth, 2013) and the statistical process (Bargagliotti et al., 2020; Franklin et al., 2007). In revealing the construct validity of the observation form, the structure of statistical knowledge for teaching was addressed in 5 components (knowledge of content and students, knowledge of content and teaching, curriculum knowledge, key developmental understandings, pedagogically powerful ideas), which served as the basis for Groth's (2013) study. The statistical process structure is based on 4 components (formulating statistical investigative questions, collecting data, analyzing and representing data, and interpreting the results), as outlined in the GAISE-II report (Bargagliotti et al., 2020). In this context, aspects of these two structures and their related components were included when developing the observation form. The components and explanations associated with these two dimensions, which form the basis for the construct validity of the observation form, are summarized in Table 1.

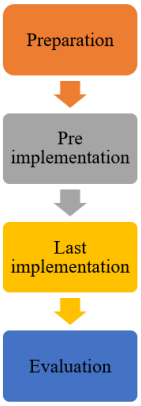
Table 1 ***Explanations regarding the knowledge component of teaching statistics and the stages of the statistical process***

Theoretical Idea	Component	Explanation
Statistical knowledge for teaching (Groth, 2013)	Knowledge of content and students	It includes information on organizing instruction to take into account students' understanding, potential errors, and misconceptions in teaching statistics, and on directing the flow of the teaching process in line with students' responses.
	Knowledge of content and teaching	Information on how to plan to teach statistics subjects and learning outcomes more effectively is important.
	Curriculum knowledge	Information on the subjects and learning outcomes related to statistics in the mathematics curriculum requires knowledge of the grade level and the order in which the subjects should be taught, taking into account the student level.
	Key developmental understandings	This component, which Groth (2013) added to the statistical knowledge for teaching model, refers to the basic information required to make sense of statistical knowledge in the field. This information is identified as an important turning point for gaining statistical subject-matter knowledge and understanding the context (Groth, 2013). Groth (2013) states this component as an important mechanism in defining cognitive substructures in the development of subject matter knowledge.

Theoretical Idea	Component	Explanation
Statistical Process (Bargagliotti et al., 2020)	Pedagogically powerful ideas	It is meant to activate situations that will support the understanding of information about statistics and facilitate students' understanding. Groth (2013) states that this component is also an element that will activate key developmental understandings. This component emphasizes providing in-depth understanding and explanations about statistical information.
	Formulate statistical investigative questions	The first stage of the statistical process is to pose a statistical research question. How the statistical process will proceed will be shaped by this research question. In this sense, the question/problem to be posed must have the characteristics of a statistical research question.
	Collect data	This is the stage where data appropriate to the determined research question is collected. At this stage, it is necessary to select a population/sample that can answer the research question, determine the data collection methods, and collect and evaluate the data.
	Analyze the data	This is the stage where the collected data is analyzed according to appropriate analysis methods, and the variability in the distributions is explained. Analyze the data, which includes organizing and classifying the collected data, displaying it with various representations (graphs, tables, etc.), and using central tendency and measures of dispersion to represent the data.
	Interpret the results	The results obtained from analyzing the data are interpreted by taking into account the variability and relating it to the context in which it is located, and a decision is made.

A preparation-implementation-evaluation process (pre-implementation–last implementation) was followed in the development of the two structured observation forms based on the two theoretical ideas summarized in Table 1. The observation form development process is schematized as in Figure 4.

Figure 4 ***Observation form development process***



When Figure 4 is examined, the first preparation work was done in the process of developing the observation form. The preparation work covers the process of creating the draft observation form, which forms the basis for the next implementation stage. This stage also includes studies on construct validity. The second stage is the implementation stage, consisting of two sub-stages and includes the usability, validity, and reliability studies of the observation form aspects with the help of

pre-post analyses. After the completion of the last implementation stage, the findings obtained were examined, and the evaluation stage was started. As a result of this stage, the two-structure observation form was finalized.

In the preparation phase, the emphasis in the literature on statistical knowledge for teaching and statistical process, and the expected teaching behaviors for these structures were examined, and the first draft of the observation form was created in line with the opinions and reviews of the project researchers. The draft form consists of a total of 53 aspects, 25 in the statistical knowledge for teaching structure and 28 in the statistical process structure. After the draft form was finalized, the first stage, the preparation stage, was completed by obtaining opinions from 6 faculty members who are experts (experts' fields of study are statistics education, teacher education, pedagogical content knowledge, and noticing skills) in the field for content validity. The feedback from the experts was collected under the titles of being observable in the classroom, the aspects being independent of each other, the expressions being clear and understandable, and being appropriate in terms of language and expression. While creating the observation form, care was taken to ensure that the roots of the observation form aspects were independent of each other in order to avoid repetition and to be able to determine different elements during the observation. The aspects were revised in line with expert opinions, taking care not to repeat each other in terms of scope and expression. Experts evaluated the observation form within the framework of the criteria of "appropriate", "improvable", and "not appropriate" regarding the aspects. As a result of the examinations made by a total of 6 experts in line with the evaluation criteria, the items coded as 'improvable' and 'not appropriate' were re-examined. After the feedback from the experts, the scope validity rates of the aspects were calculated using the Lawshe (1975) technique. The Lawshe (1975) technique was used to examine whether the items in the observation form provided content validity. In this technique, the aspects are graded into three categories: "the item measures the targeted structure", "the item is related to the structure but unnecessary," and "the item does not measure the targeted structure," and a formula is presented to calculate the content validity rate. According to this formula, the content validity rate is obtained by subtracting 1 from the ratio of the number of experts (Ne) stating the 'appropriate' or 'necessary' opinion regarding each item to half of the total number of experts (N) (KGO = Ne/(N/2)-1). As a result of the calculation, the content validity ratio can take a value between -1 and +1. The critical values of the content validity ratios change according to the number of experts, and the critical value was determined as 0.99 according to the number of experts used in the study (6 experts) (Lawshe, 1975). In the last case, the evaluations of a total of 6 experts and the values obtained from the Lawshe technique were evaluated together, the relevant aspects were removed, and changes were made to the relevant items.

When the expert opinions and Lawshe technique results are considered together, the number of aspects in the sub-dimensions of curriculum, key developmental understandings and pedagogically powerful ideas under the statistical knowledge for teaching dimension in the observation form remained the same. Some aspects under the knowledge of content and student were combined and new aspects were added, increasing the number of aspects of this component by 1. One aspect was removed from knowledge of content and teaching component, and it was decided to add 1 aspect to the key developmental understandings dimension. In the last case, the number of aspects under the knowledge of content and teaching dimension decreased by 2. On the other hand, there was no change in the number of aspects in the dimensions of formulate statistical investigative questions, data collection and data analysis-representation under the statistical process stages dimension, only some aspects were improved in terms of meaning and grammar. In addition, 1 aspect was removed

from the dimension of interpreting the results. As a result, there were a total of 51 aspects in the observation form, which was finalized in line with the expert opinions and Lawshe technique results. In the dimension of statistical knowledge for teaching, 1 aspect was added to the knowledge of content and students component, 2 aspects were removed from the knowledge of content and teaching component as a result of the merger; in the dimension of statistical process stages, 1 aspect was removed from interpret the results component. With the arrangements made after expert opinions, the observation form was finalized with 51 aspects (statistical knowledge for teaching 24, statistical process 27).

The second stage of the observation form development process, the implementation stage, was carried out in two sub-stages. In the first stage, preliminary analyses were conducted as a pre implementation to examine the usefulness of the aspects in the observation form and their inclusion in statistics teaching. Within the scope of the pre implementation, a statistics teaching conducted for two class hours was analyzed in line with the observation form. After these analyses, studies were conducted on the scope of the aspects and what kind of behaviors they measured. In the second phase of the implementation, six-hour lessons covering all stages of the statistical process were analyzed with the help of the observation form. The classroom observations were conducted by a researcher with experience in statistics education; relevant field notes were taken during the observations, and the transcribed lessons were subsequently prepared for coding. The selection of the lessons was determined by ensuring a variety of topics and being related to graphs, research questions, collect data and analyze the data. The selection of the lessons in which these topics were covered was influenced by the idea that the diversity of the aspects in the observation form for the structure created in line with the statistical process stages and that they would include topics based on different stages in order to see their functionality was effective. Within the scope of the needs analysis, information on the analyzed lessons—including teacher, teaching experience, school achievement level, lesson duration, grade level, and learning outcomes—is presented in Table 2.

Table 2 ***Information on the lessons analyzed within the scope of the needs analysis***

Teacher	Teaching Experience	School Achievement Level	Duration	Grade Level	Learning Outcomes
T1	8-16 years	Medium Level	2 hours	Grade 7	M.7.4.1.1. Constructs and interprets line graphs related to data. M.7.4.1.3. Constructs and interprets circle graphs related to a data set.
T2	0-8 years	Low Level	2 hours	Grade 5	M.5.3.1.1. Formulates research questions requiring data collection. M.5.3.1.2. Collects data related to research questions and represents them using frequency tables and bar graphs.
T3	16+ years	High Level	2 hours	Grade 7	M.7.4.1.2. Determines and interprets the mean, median, and mode of a data set.

The analyses were conducted simultaneously by three researchers. As a result of the analyses conducted by the three researchers, the differences between the codes were discussed in meetings and a consensus was reached and then the necessary arrangements and changes were made in the

observation form. After these reviews by three researchers, the second part of the implementation phase was completed and the evaluation phase was started.

The arrangements and changes made during the evaluation phase were grouped under three themes: combination, removal and regulation aspects. Combination covers the changes and arrangements made when it was observed that some aspects covered each other while the observations made for the needs analysis were analyzed in line with the observation form. Under the combination theme, 6 aspects were merged into 3 aspects by merging them in pairs. As a result of the analysis, the observability of the 7 aspects in classroom practices was discussed and it was decided to remove these aspects from the form in line with the operability criteria. Finally, all aspects in the observation form were re-examined and 16 aspects were edited in terms of grammar and meaning. For example, in the knowledge of content and students component of the statistical knowledge for teaching dimension, the aspect "Addressing the subject with multiple approaches that will enable students at different levels to understand" was edited as "Supporting the topic with different explanations to facilitate the understanding of students at varying levels" in order to be more understandable.

3. Findings

The observation form development process consisted of four phases: preparation, implementation (pre-last), and evaluation. The first phase, the preparation phase, was completed after the expert opinions were obtained. After receiving expert opinions for the scope and construct validity of the observation form, the implementation phase of the development process was started. The implementation phase consists of two sub-phases. In the first part of the implementation phase, a preliminary analysis was carried out to reveal the validity of the observation form. As a result of the preliminary analyses conducted by three researchers over 2 lesson hours, 7 aspects out of a total of 51 were deemed appropriate to be removed, and 7 aspects were edited in terms of language and meaning. In this context, the researchers conducted repeated analyses using the observation form for observations made within the scope of the needs analysis (6 lesson hours). Following analyses by three researchers, the differences between the codes were discussed in online meetings, and a consensus was reached. In this direction, the necessary arrangements and changes were made in the observation form. These arrangements and changes were grouped under three themes: combination, removal, and regulation indicators. Table 3 includes the themes and explanations of the arrangements made.

Table 3 ***Changes made to the observation form as a result of the needs analysis***

Theme	Explanation	Number of Changed Aspects
Combination	While the data regarding the observed lessons were being analyzed in line with the observation form, it was observed that some aspects covered each other. Therefore, it was foreseen that there might be confusion in the coding. It was decided to combine such aspects by making appropriate arrangements.	6
Removal	In the meetings held on the analysis, the situations regarding the availability of some aspects in classroom applications were also discussed. In this context, it was decided as an important criterion to examine the availability (operability) of the aspects in statistics teaching.	7
Regulation	In the analyses, all aspects in the observation form were re-examined in terms of grammar and meaning and edited in order to ensure that	16

Theme	Explanation	Number of Changed Aspects
	different researchers could derive the same meaning from the relevant aspect and to increase the reliability of the coding.	

As a result of the analyses conducted for the second stage of the implementation section, at the end of the process that started with 51 aspects, it was decided to combine 6 aspect pairs, remove 7 aspects and make arrangements in 16 aspect expressions. For example, in the key developmental understandings dimension, two aspects were included: "Stating expressions such as change, representation, center as important ideas in statistics teaching" and "Emphasizing the big ideas of statistics teaching (change, center, representation, randomness, etc.) within the subject". In the online meetings, based on the course analyses, it was decided that the two aspects could be under the same roof in terms of emphasizing and indicating important ideas such as change, center, and representation, and even that they should be combined because they were repetitive. In the last case, the two aspects mentioned were combined under a single aspect as "Framing the big ideas of statistics instruction (such as variation, center, representation, randomness) as key concepts." As an example for this aspect, the following statement was made in the lesson of T3, which covered the concepts of arithmetic mean and range:

> "....There is an average question about the graph, those questions are good questions, those types of questions will help us a lot in the 8th grade next year. Let's see, it says, the weekly temperature change of a city, look at the change, children said look at the change, what is the name of the graph?"

When T3's statement was examined, it was seen that it fell within the scope of both aspects, that the two aspects could not be distinguished in such examples and that there was no significant difference in terms of scope. It was determined that both aspects were within the same scope in terms of reinforcing the expression or idea of change. Based on such examples, it was decided to combine these two aspects.

In the observation form, there are two aspects in the dimension of pedagogically powerful ideas: "Asking questions to ensure conceptual understanding in the teaching process" and "Asking questions and producing strategies that can eliminate students' mistakes about statistics". It was prioritized that the statements in both aspects be separated from those related to the KCS (knowledge of content and students) component, and that they focus on the deep consideration of conceptual understanding within the dimension of pedagogically powerful ideas. Based on this idea, they were combined into a single aspect: "Posing critical questions during instruction to promote conceptual understanding and address students' errors related to statistics". In the online meetings held, it was decided to combine these aspects into a single aspect, given that both focused on asking questions and that conceptual understanding could be developed during the teaching process, while possible errors could be eliminated.

The idea of considering the two aspects in the KCS dimension, "Revealing possible errors and misconceptions that may develop in students" and "Asking critical questions to determine students' difficulties regarding the subject or concepts", within the scope of a single aspect, emerged. Since both aspects involve determining students' errors, misconceptions, and difficulties and serve the same purpose, they were combined. For example, the following statement was made in the lesson of teacher T1 on arithmetic mean and range:

> "...Children, can we say that the arithmetic mean is 17 by looking at the numbers in this table without finding the arithmetic mean?"

When the relevant statement in the analysis example is examined, it is seen that this question is asked by the teacher to determine the difficulties of the students regarding the subject or concept (calculation of arithmetic mean, conceptual understanding of the relevant procedure) and to deepen it, therefore the teacher also aims to reveal the errors and misconceptions that may develop in the students in this process. Therefore, it is thought that such statements contain both aspects in a natural structure. In this context, it was decided to combine the two aspects in the KCS component into "Posing questions aimed at revealing potential misconceptions and difficulties that may arise among students," and to consolidate them under a single aspect.

In the CT (knowledge of content and teaching) component, it was decided to remove the aspect of "Presenting a context appropriate to the nature of the subject" from the observation form, considering that it is included in aspects such as "Drawing attention to the production of research problems appropriate to the context of the subject" in the SRQ (formulating statistical research questions) component, "Interpreting the obtained results in an appropriate context" in the IR (interpret the results) component, and that it better represents the practices related to the statistical process and its stages rather than the structure of teaching knowledge. Another aspect removed from the observation form is as follows.

The aspect of "Drawing attention to the importance of collecting data appropriate to the research problem" in the data representation dimension, "Drawing attention to the importance of selecting a sample appropriate to the problem context and collect data" and "Ensuring that students decide on the appropriate collect data method (questionnaire, measurement, database, etc.)" under the data representation stage in the observation form were discussed as including applications for this aspect, and the relevant aspect was removed from the observation form in order to avoid situations involving repetition between the aspects.

In the process of removing an aspect, the fact that the aspect was not directly encountered in the courses where the needs analysis was conducted did not factor into this decision. In deciding to remove an aspect, it was considered that the applications related to this aspect may fall within the scope of another aspect, or that it is difficult to encounter the relevant aspect in the applications used in the classroom environment. As an example of this process; although the aspect of "Using technological tools to highlight conceptual understanding in analyze the data" in the analyze the data-representation dimension of the observation form was never encountered in the analysis of the lesson observations made within the scope of the needs analysis, it was not removed from the observation form because it was an aspect that could emerge in future observations. Therefore, while the researchers decided to remove the aspects from the observation form, they did not rely solely on whether the aspects were observed in the analyses of the 6 lesson hours.

In the KCS component, discussions were held on expressing the aspect "Addressing the subject with multiple approaches that will enable students at different levels to understand" more clearly. In this context, it was decided to organize it as "Supporting the topic with different explanations to facilitate the understanding of students at varying levels". Given that the expression of approach may limit the aspect, a change in this direction was deemed appropriate to address instructional explanations more broadly.

It was considered to add the expression "drawing" to the aspect "Drawing attention to the basic elements of graphs (scaling, axis name, graph title, etc.)" in the data analysis-representation

dimension. After this arrangement, the relevant aspect was arranged as “Drawing attention to the basic elements of graphs (scaling, axis name, graph title, drawing, etc.)”. It was decided to add the expression drawing to this aspect as a result of the analyses. For example, the following expression was used in T2’s lesson on frequency table and column chart:

> “...So what was I doing after that? I was creating the column chart according to these tables, I could make comments according to the heights of those columns in the column charts...”

When the teacher’s statement was examined, it was seen that he emphasized the basic elements of the graphs as well as the drawing of the graph. It was determined that the teacher actually emphasized drawing the graph as a basis for teaching graphs, highlighting the heights of the columns in the bar graph. In order to include the emphasis regarding the drawing of the graph in the scope of this aspect, it was decided to include the expression “drawing” in the relevant aspect. In this context, after the second stage of the implementation process for developing the observation form, changes, additions, and removals were made to relevant aspects, and the evaluation stage was initiated in the studies to give the observation form its final form.

In the evaluation phase, the observation form with two structures was finalized, including 41 aspects: 17 for the statistical process structure of the observation form and 24 for the statistical knowledge-for-teaching structure. In the final version of the observation form, 3 aspects were included in the formulate statistical investigative questions stage, 7 in the collect data stage, 10 in the data analysis and representation stage, and 4 in the interpretation stage of the results for the statistical process structure. For the statistical knowledge for teaching structure, 2 aspects were included in the curriculum knowledge component, 4 in the content and student recognition component, 6 in the knowledge of content and teaching component, 2 in the key developmental understanding component, and 3 in the pedagogically powerful ideas.

4. Discussion

The aim of the present study was to develop a two-structure observation form to evaluate the statistics teaching practices of secondary school mathematics teachers. In line with this purpose, the theoretical framework of the study in developing the observation form was formed based on the components of statistical knowledge for teaching and statistical process stages that are prominent in the literature. At the end of the process, a two-structure observation form was developed that included the dimensions of statistical knowledge for teaching and statistical process stages. There are 17 aspects in the statistical knowledge for teaching dimension and 24 aspects in the statistical process stages dimension. When the literature is examined, although there are studies on teachers’ statistics teaching practices (Batur, 2021; Chick & Pierce, 2008; Estrella et al., 2015; Henriques & Ponte, 2014; Jacobbe, 2007; Kuzle & Biehler, 2015; González, 2014; Verbisck et al., 2022), it is seen that these studies usually focus on a specific dimension or are addressed in terms of a single structure. In this context, the development of an observation form based on the theoretical structure for the evaluation of statistics teaching and whose validity and reliability studies have been conducted is considered as an important output. Although observation forms have been developed in studies to examine statistics teaching (Özmen, 2015; Uyanık, 2022; Yeniçırak, 2020), it is seen that they focus on a specific dimension or subject. Considering that the “Statistical research process” is included as a theme (learning area) in the new mathematics curriculum published within the scope of the Turkey Century Education Model (Ministry of National Education [MoNE], 2024), the importance and necessity of considering the statistical process as a whole, not a single dimension, comes to the

fore once again. In the studies conducted, it is emphasized that this process should be experienced holistically (Newton et al., 2011; Özmen, 2015; Topan, 2019; Watson, 2006). Accordingly, it is expected that the application practices to be carried out in statistics education will serve the determined themes simultaneously. As a matter of fact, the observation form developed within the scope of this study differs from the literature in terms of being created based on two theoretical structures, being developed in line with the reforms and reports regarding statistics education, and revealing the validity of the content and construct.

In the development of the observation form, six aspects were combined in total. For example, in the key developmental understanding dimension two aspects were combined under a single aspect as "Framing the big ideas of statistics instruction (such as variation, center, representation, randomness) as key concepts". Burrill and Biehler (2011) have indicated familiarity with basic statistical terms and concepts as one of the aspects of statistical literacy. While it is argued that the two biggest ideas in statistics education are distribution and inference, at this point, it emphasizes that teachers need to develop both their content knowledge and their pedagogical content knowledge of statistics (Shaughnessy, 2019). It is crucial for teachers to know, define, and make sense of these ideas that constitute the identity of statistics (Garfield & Ben-Zvi, 2008). This is because the big ideas have a special place in forming the conceptual foundations of statistics-related topics and strengthening teachers' content knowledge (Sorto, 2004). Thus, it is clear that understanding the big ideas in statistics is important and necessary. The other two aspects in the dimension of pedagogically powerful ideas were combined under a single aspect as "Posing critical questions during instruction to promote conceptual understanding and address students' errors related statistics." It is emphasized that it is quite important for teachers to identify the fundamental ideas that form the core of the subject (Batanero & Borovknic, 2016). At this point, it is considered important for teachers to expand their teaching knowledge based on a deep conceptual understanding of statistics (Batur, 2021). Indeed, studies have revealed teachers' inadequacies in supporting students' awareness of their own mistakes (Groth, 2014; Vermette & Savard, 2019; Watson et al., 2008b). These teachers have significant shortcomings in terms of what types of questions to ask students and how to create cognitive conflict in them without directly giving the answer (Watson et al., 2008b). At this point, it is essential for teachers to ensure that students think actively in statistics teaching. In doing so, they should be able to evaluate the strengths and weaknesses of methods that facilitate students' learning of statistics and deepen their understanding, and select the most appropriate ones for their teaching (Ijeh, 2012). It is also recommended that ideas be addressed in relation to each other rather than independently for a conceptual understanding of statistics (Pfannkuch & Ben-Zvi, 2011). As a matter of fact, some aspects in the observation form have been combined to ensure that the targeted situations can be observed in a clear, precise, and understandable manner. On the other hand, seven aspects have been removed entirely from the observation form. For instance, in the CT component, the aspect "Presenting a context appropriate to the nature of the subject" was removed, considering that it is included in the SRQ ("Drawing attention to the production of research problems appropriate to the context of the subject") and IR ("Interpreting the obtained results in an appropriate context") components, and better represents the teaching practices in these components. The researchers have emphasized the importance of context-based statistics education (Bargagliotti et al., 2020; Casey et al., 2021; Makar & Ben-Zvi, 2011; Yılmaz et al., 2023). Students who participate in tasks across various contexts in the statistical process could make advanced statistical interpretations (Pfannkuch, 2011). It has been highlighted that "contextual information should be an integral part of statistical investigations" and each statistical investigation phase has to use of context knowledge (Yılmaz et al., 2023). Therefore, context-related aspects have been included in the statistical process

component (IR and SRQ) of the observation form. In addition, the aspect of "Drawing attention to the importance of collecting data appropriate to the research problem" in the data representation dimension was removed from the observation form in order to avoid situations involving repetition between the aspects under the same dimension.

In developing the observation form, the instructional objectives from studies in the literature were also taken into consideration. While the importance of using technology for teaching statistics is emphasized in the studies conducted (Carver et al., 2016; Cobb & McClain, 2004; Kuzle & Biehler, 2015; Henriques & Ponte, 2014), it is noteworthy that the use of technology is not directly considered as a basic element in teaching statistics (Özmen, 2015; Uyanık, 2022; Yeniçırak, 2020). From this perspective, the fact that the observation form developed also highlights teachers' integration of technology into their statistics teaching practices constitutes an important output. At this point, the aspect "Using technological tools to highlight conceptual understanding in analyze the data" was included in the two-structure observation form. On the other hand, although this aspect was not encountered in the observations made in the first stage, it was not removed from the observation form considering the importance of technology in providing conceptual understanding in teaching statistics. Indeed, in the GAISE-II report (Carver et al., 2016), this aspect was presented directly as an instructional recommendation and was considered as an important initiative for the development of statistics teaching. Boz (2017) also stated that it was a limitation that behaviors that could not occur in a single lesson and could not be observed in the classroom were not included in the observation form. This indicates that the observation form developed was comprehensive and was not limited to a single lesson. In addition, the use of real data is emphasized in statistics teaching (Carver et al., 2016; Franklin et al., 2007; Watson, 2006), and it is emphasized that information in sources such as newspaper news, articles, and reports should be included in statistics teaching in order to be understood and interpreted statistically (Garfield, 1999; Reston, 2005; Schield, 2006). At this point, it is stated that in order for students to work with real data, they will need basic statistical information as well as interactive classroom applications for analyzing and evaluating this information (Topan, 2019). In this context, the detailed inclusion of components that will help monitor the applications to be made step by step while working with real data in the observation form developed is considered as an important output. In addition, the aspects included in the observation form, such as "Drawing attention to the importance of selecting a sample appropriate for the context of the problem and collect data", enable students to reason on many issues such as the reality and credibility of data in various sources such as newspapers, news, etc. in daily life, and the appropriateness of collect data processes. It is thought that such aspects in the observation form will also contribute to the achievement of important goals for statistics education, such as the development of researcher identity in real life (Rumsey, 2002). From this perspective, it is revealed that the observation form developed is also important in terms of including recommendations for achieving the goals considered important for statistics education and teaching. It is also a guide for teachers in terms of including aspects that can be included in teaching practices as well as in the evaluation of statistics teaching. In this way, it will contribute to the achievement of the ultimate goal of "statistical literacy for everyone" (Bargagliotti et al., 2020).

Lastly in the development of the observation form, sixteen aspect expressions were revised. For instance, the aspect "Addressing the subject with multiple approaches that will enable students at different levels to understand" was decided to organize as "Supporting the topic with different explanations to facilitate the understanding of students at varying levels". This revision aimed to address instructional explanations in a broader scope. The role of the teacher is to provide guided

learning support in a structure that allows learners to learn by thinking for themselves to the extent that they need (Lajoie, 2005; Masters & Yelland, 2002). Leinhardt and Steele (2005) argued that instructional explanations that take students' prior knowledge into account are effective, thereby enabling the information conveyed to be consistently retained in students' minds. When providing different instructional explanations to students at different levels, relevant student characteristics should be considered, such as skills, cognitive abilities, personality traits, learning styles, areas of interest, and motivation levels (Wittwer & Renkl, 2008). Based on these characteristics, it can be said that it is important and necessary for teachers to include different explanations in their lessons. The studies reveal that instructional explanations can be effectively combined with learners' cognitive activities, while also demonstrating that teachers' instructional support is a truly important element in constructivist learning environments (Hardy et al., 2006; Klahr & Nigam, 2004). Indeed, if students have basic knowledge, they can construct knowledge on their own. However, under these conditions, presenting instructional explanations may hinder or complicate active processing in some students and may have detrimental effects on students' knowledge construction process (Wittwer & Renkl, 2008). On the contrary, providing additional explanations to help students develop their knowledge may be beneficial for students who have limited knowledge on a subject (Brusilovsky, 2001).

It is thought that the observation form, which is created by using statistical knowledge for teaching and statistical process stages together, will provide an opportunity to deeply evaluate statistics teaching practices such as teachers' verbal expressions during the teaching process, assignments in the classroom, and use of different course resources. In addition to having a good level of statistical knowledge (Aliaga et al., 2005; NCTM, 2000), teachers need to be able to make the best representations and explanations on the subject, recognize the difficulties experienced by students, and determine and implement appropriate strategies to overcome them (Yeniçırak, 2020). At this point, the aspect of "Supporting the topic with different explanations to facilitate the understanding of students at varying levels" was included in the two-structure observation form. It is stated that in-class observations focus on teaching skills, teaching methods, use of teaching tools, evaluation of students' learning steps and teacher-student interaction (Rizvi, 2010). With teacher-student interaction, meaningful learning of students will occur, information exchange will increase, interest in learning will be felt and mutual respect between teachers and students will be realized (Abdullah et al., 2012). It can be said that this situation also points to the functionality of the aspect of "Posing questions aimed at revealing potential misconceptions and difficulties that may arise among students" in the observation form. Considering the stated focal points, it is thought that the developed form will provide teachers with the opportunity to monitor and improve themselves regarding the statistical knowledge for teaching and the stages of the statistical process.

It is stated that classroom observations are very important at this point, as the quality of teachers' classroom practices must be determined in order for students to learn effectively (Bruns et al., 2018). In fact, studies have shown that teachers have very limited knowledge of the meanings of statistical concepts (González, 2014; Watson et al., 2008). In the literature, it is pointed out that improving teachers' teaching knowledge is important in order to increase the effectiveness of statistics teaching (Batur, 2021; Groth, 2007; Simon, 2006; Silverman & Thompson, 2008; Watson et al., 2009). It is stated that teachers should give importance to extracting meaning from data, examining variability (Pfannkuch & Wild, 2008), focusing on the meaning of basic statistical concepts, and understanding and developing students' reasoning processes (Garfield & Everson, 2009; Pfannkuch & Ben-Zvi, 2011). The increase in teachers' statistical competence will also be reflected in their teaching of statistics. At this point, the importance and necessity of the aspect "Framing the big ideas of statistics

instruction (such as variation, center, representation, randomness) as key concepts" in the observation form also comes to the fore.

4.1. Limitations and Future Directions

While the current study offers valuable insights into statistical education, several limitations should be acknowledged. Firstly, while developing the observation form, the statistical learning outcomes in the current mathematics curriculum are quite limited, and they predominantly focus on operation-based content, such as calculating averages. This situation may have limited observation of the effectiveness of certain aspects of the observation process, such as the use of technology in teaching statistics. In the new mathematics curriculum (MoNE, 2024), the statistical process is also addressed as a separate learning area, and it is recommended that students experience all stages of this process holistically. It can be said that aspects of the observation form grounded in statistical thinking and literacy will play an important role in teachers' development of classroom applications of the new curriculum. Secondly, classroom observations were conducted during two class periods by three different mathematics teachers in the 5th and 7th grades. To comprehensively observe all middle school statistical learning outcomes, observations can also be conducted across all grades. Also, observing more teachers' lessons will yield more comprehensive results regarding all aspects included in the observation form. Lastly, the schools where classroom observations were conducted were selected to include one school from different achievement level (low, medium, high). It is possible to select more schools from each achievement level, and a broader range of schools could be selected by considering different variables such as socioeconomic status and region (e.g., village, city center).

It can be said that the developed observation form will contribute to studies on statistics in the literature by providing important aspect descriptions, and will serve as a guide that teachers can draw on while directing their teaching. In the literature, classroom observations are widely recognized as an important tool for improving teachers' professional development (Haep et al., 2016; Hong et al., 2020; Lam, 2001). Regular follow-ups during this development process can also help detect variables that are sometimes neglected in the teaching process, among others. Thus, it will make a significant contribution to identifying and improving missing/faulty points in the teaching process. Since statistical processes are considered problem-solving in GAISE reports (Bargagliotti et al., 2020; Franklin et al., 2007), it is important to carefully monitor each stage of this process. It is stated that in current education, teachers mostly focus on the results of the problem-solving process and ignore students' activities during it, so the examination of teacher behaviors at each step of problem-solving can be conducted using observation charts (Yıldız & Güven, 2017). It is also stated that these observations can be used for consultancy purposes for the development of teaching to identify, evaluate, and improve the current situation (Hong et al., 2020). At this point, it is thought that the developed observation form will serve as a guide for teachers in their professional development processes.

4.2. Conclusion

After the changes and arrangements made during the evaluation phase, the observation form was finalized. After the evaluation phase, the observation form was completed with a total of 41 aspects, 17 in the statistical knowledge for teaching dimension and 24 in the statistical process dimension. It is expected that the observation form, whose validity and usability have been established, will serve as an important data tool in future studies on statistics teaching. In addition, it is anticipated that it will take its place in the literature as an important guide for identifying observed and unobserved behaviors and for shaping teaching by analyzing teachers' statistical teaching using this form.

5. Declarations

5.1. Conflict of interest

The authors declare that they have no known competing financial interests, institutional affiliations, or personal relationships that could have appeared to influence the work reported in this paper.

5.2. Funding

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5.3. Author contributions (CRediT)

Zeynep Medine Özmen: Conceptualization; Methodology; Investigation; Data Collection and Analysis; Writing—review & editing

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Hayrunnisa Ayyıldız: Methodology; Investigation; Data Collection and Analysis; Writing—review & editing

Sefa Uyanık: Methodology; Investigation; Data Collection and Analysis; Writing—review & editing

5.4. Data availability statement

Data are available from the corresponding author upon reasonable request.

5.5. Ethics approval

This study was approved by the Trabzon University Social and Humanities Scientific Research and Publication Ethics Committee (Approval Number: E-81614018-000-73; Approval Date: 20.01.2021). Informed consent/assent was obtained from all participants.

5.6. Use of artificial intelligence (AI) tools

GPT-5 was employed only for translation and language correction. However, all data collection, analysis, and interpretation were conducted and validated entirely by the authors. All AI-generated content was reviewed for scientific accuracy, ethical compliance, and source reliability by the author(s), who assume full responsibility.

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Investigation of the relationships between preschool children's theory of mind skills and symbolic representations in drawings

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ABSTRACT

This research was conducted to evaluate whether there is a relationship between symbolic representations in preschool children's drawings, Theory of Mind (ToM) skills, and age. The research used a correlational survey design. The study group consisted of 120 children aged 4–6 years. Data collection tools were "Theory of Mind Tasks," "Representational Drawing Tasks," and a "Personal Information Form." In the first application, the tests were administered individually and face-to-face to the children. In the second application, the children's drawings were evaluated. As a result of the analyses, it was determined that children's representational drawing success scores increased with age and that girls had higher scores than boys. Furthermore, it was concluded that the sub-dimensions of theory-of-mind skills were significantly related to representational skills in drawings.

KEYWORDS: Theory of mind; Symbolic representations; Preschool; Drawing; Child; Early childhood

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1. Introduction

The concept of representation is broadly defined as the mental evocation of events, phenomena, and objects through symbols or images, and it plays a central role in cognitive development (Bakırcıoğlu, 2012; Bredekamp, 2015). Symbolic representation, in particular, involves mentally associating one object or situation with another to form the basis for a wide array of cognitive and linguistic abilities. As Berk (2015) noted, symbolic skills are expressed through mental images and conceptual groupings, contributing directly to thinking, language development, and imitation.

Building on Piaget's theory of cognitive development, the "symbolic function substage" between ages 2 and 4 marks a developmental milestone in which children become capable of mentally representing unseen objects or situations. However, representational abilities at this stage are not without limitations; egocentrism and animism may hinder children's ability to differentiate between internal representations and external realities (Santrock, 2011). A substantial body of research (Gopnik & Slaughter, 1991; Gopnik & Meltzoff, 1997) has investigated how symbolic functioning contributes to the emergence of Theory of Mind (ToM). Between the ages of 3 and 5, children begin to understand that others may hold beliefs that differ from reality, an insight that marks a critical stage in ToM development (Wellman et al., 2001).

In general terms, "Theory of Mind" is the ability to attribute independent mental states to both ourselves and others to predict and explain behavior (Premack & Woodruff, 1978; Wellman, 2020).

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Perner (1999) and Baron-Cohen et al. (1985) argue that ToM involves not only the recognition of others' beliefs and intentions, but also an internal monitoring of one's own mental states. Gopnik and Meltzoff (1997) determined that when children can report their own mental states, they can also report the mental states of others. Early studies focused primarily on demonstrating normative development, identifying simple desire around age 2 (Wellman & Woolley, 1990), beliefs around ages 3–6 (Wellman et al., 2001; Wimmer & Perner, 1983), and more advanced aspects of the theory of mind in middle childhood and beyond (Carpendale & Chandler, 1996).

Subsequent studies have examined factors that cause individual differences, such as theory of mind and language (Jenkins & Astington, 1996) and demographic characteristics (Cutting & Dunn, 1999). Doherty (2009) identified ToM as inherently tied to mental representation, while Keskin (2005, 2010) provided empirical support for this relationship, showing that children with more advanced ToM skills produce richer symbolic representations in both artistic and play contexts. Most studies have emphasized verbal (Hou et al., 2023; Hughes, 2011; Jenkins & Astington, 1996; Lillard & Kavanaugh, 2014) or social indicators (Güven et al., 2019; Hou et al., 2023; McCormick et al., 2022), while the representational aspect, particularly in visual formats such as drawings, remains less thoroughly investigated.

Walker and Murachver (2012) suggested that symbolic function and language may stem from a shared cognitive base linked to ToM. Granti (2004) demonstrated that ToM abilities begin to emerge around age four, as indicated by false-belief tasks and mental-state vocabulary assessments. Keskin (2005) further supported this by identifying connections between imaginative role-play and ToM development. Drawings as symbolic artifacts have long been recognized as valuable indicators of children's cognitive, psychomotor, and emotional development (Keskin, 2010). Beyond mere expression, drawings serve as windows for children's internal representation of the world (Thomas & Silk, 1990; Kındap & Sayıl, 2005). Thompson (1995, 2006) highlighted how visual arts allow children to communicate complex ideas through nonverbal modes, and Liben (2009) stressed the cognitive benefits of early exposure to symbolic tools such as books, maps, and drawings.

Despite this recognition, empirical work connecting children's visual-symbolic expressions to ToM development remains scarce. Recent Turkish studies have added valuable cultural context by exploring ToM in relation to social problem solving (Arslan, 2021), story comprehension (Sarı & Altun, 2018), and developmental predictors (Arıkan & Tüfekçi, 2020). However, these studies similarly prioritize behavioral or verbal measures, overlooking visual-symbolic outputs such as drawing. This study focuses on identifying which symbolic elements are present in preschool children's drawings, examining whether these symbolic representations are connected to ToM abilities, and investigating the possible relationships between symbolic representations and ToM changes across age and gender.

1.1. Research Questions

1. Does the theory of mind development differ by age in four, five, and six-year-old children?
2. Does the theory of mind development differ by gender among four-, five-, and six-year-old children?
3. Do symbolic drawing scores differ by age in four, five, and six-year-old children?
4. Do symbolic drawing scores differ by gender among four-, five-, and six-year-old children?
5. Does the relationship between theory of mind tasks and symbolic drawing scores vary by age?

6. Does the relationship between theory of mind tasks and symbolic drawing scores vary by gender?

2. Method

2.1. Research Design

This study was designed using a relational survey model, which is a quantitative research method. The survey model aims to describe a past or present situation as it exists (Karasar, 2011, p. 77). The relational screening model aims to examine the degrees of relationship that exist or are thought to exist between two or more variables, as well as the ways in which the variables influence each other and their changes simultaneously (Karasar, 2019).

2.2. Participants and Procedure

The study group consisted of 120 children aged 4–6 attending two public kindergartens in a city center in the Black Sea Region of Turkey. Forty children of all age groups were included in this study. The study group was selected using an easy sampling method, which involves including individuals or groups in a study based on the researcher's reach or accessibility (Ekiz, 2009, p. 106). Table 1 shows the demographic characteristics of the study groups.

Table 1 ***Distribution of children by age and gender***

Category		
Age	4 years old	51 (42.5%)
	5 years old	37 (30.8%)
	6 years old	32 (26.7%)
	Total	120 (100.0%)
Gender	Girl	63 (52.5%)
	Boy	57 (47.5%)
	Total	120 (100.0%)

Table 1 shows the distribution of study groups according to age and sex. Accordingly, the number of 4-year-old children was 51 (42.5%); the number of 5-year-old children was 37 (30.8%); and the number of 6-year-old children was 32 (26.7%). Regarding sex distribution, 63 girls (52.5%) and 57 boys (47.5%) comprised the study group.

2.3. Data Collection Tools

Data were collected using a personal information form; the First-Degree False Belief Task, the Second-Degree False Belief Task, and the Faux Pas (making a blunder and understanding blunder) Test to determine theory of mind skills; and Golomb and Farmer's (1983) tasks "Draw children playing" and "Draw a landscape with trees, flowers and a lake in it" for representative drawings.

2.3.1. The First-Degree False Belief Task

The first-degree false-belief task was developed by Baron-Cohen et al. (1985). Using the false-belief task at the first degree, they aimed to measure one person's understanding of another's false belief. The Sally-Anne paradigm: Sally and Anne are two toy characters. First, Sally places a marble in her

basket. She then leaves the stage, and Anne moves the marble and hides it in her own basket. Then Sally comes back. Question: "Where will Sally look for her marble?" If the child points to the marble's old location, he or she passes the False Belief question. If the child points to the marble's current location, he or she fails because the child does not consider Sally's belief.

2.3.2. The Second-Degree False Belief Task

Second-degree false-belief tasks were developed by Stone et al. (1998). These tasks have a more complex structure than first-degree false belief tasks. In second-order false-belief tasks, one is expected to attribute false beliefs to the person in the story. Story: Martha and Oliver talk in the kitchen. Oliver is eating cookies. Oliver leaves the room. Martha closes the cookie box and places it in the closet. Oliver looks through the keyhole when he is out of the room and sees Martha moving the cookies. Belief question: "Where does Martha think Oliver thinks the cookies are?" If the child points to the table, he or she will be successful. If the child shows the locker, it fails.

2.3.3. Faux Pas Comprehension Task

Faux Pas tasks involve more complex structures, such as metaphors and irony, and are the highest-level tasks of the theory of mind (Stone et al., 1998). Story: Anne has had a big wedding and many gifts. Jeanette bought Anne a crystal bowl at a wedding. One year later, Jeanette was at Anne's for dinner. Jeanette accidentally dropped a wine bottle onto the crystal bowl, shattering it. Jeanette said, "I am so sorry, I broke the bowl." Anne's mom says, "Do not worry, I have never loved it anyway. Someone gave it to me for my wedding." Questions: (1) "Has a person said something that they should not have said?" (2) "Who is it that says something that they should not?" (3) "Why is what Anne says something that should not be said?" (4) "How did Jeanette feel?"

2.3.4. Application of Theory of Mind Tasks

For theory-of-mind tasks, the researchers worked one-on-one with the children in a quiet room at the school. Cerrah-Özsevgeç and Kontaş (2021) evaluated children's theory-of-mind skills using Turkish translations of theoretical scenarios that were animated for the study. While the children were watching the animations, the researcher told them the story. At the end of the animation developed for each task, the children were asked questions. Children who answered three questions correctly in each task were classified as "passed the test," while those who failed to answer were classified as "did not pass the test."

2.3.5. Representative Drawing Tasks

To determine the children's representative drawing achievements, Golomb and Farmer's (1983) tasks "Draw children playing" and "Draw a landscape with trees, flowers, and lakes" were used in the study. To determine representative drawing success scores, the Representative Drawing Success Criterion Evaluation Form developed by Kındap (2004) was used.

2.3.6. Implementation of Representative Drawing Tasks

During the application, the children were given A4-sized paper and crayons. Each of the two paintings was made two weeks apart, and the application was carried out in groups, with attention paid to seating arrangements to prevent the children from affecting one another. Before starting the picture, the children were given instructions: "Draw children playing" and "Draw a landscape with trees, flowers, and a lake."

2.4. Data Analysis

Data analysis was performed using SPSS, and the results were evaluated at the 95% confidence level. Two raters evaluated the children's drawings separately. The harmony among the evaluators was analyzed using correlation, and Kendall's tau-b tests; the differences in achievement scores by age

were analyzed using ANOVA, and the differences by gender were analyzed using t-tests. The relationship between the sub-dimensions of the theory of mind was analyzed using the chi-square test.

2.5. Validity, Reliability, and Ethical Considerations

The correlation and Kendall's tau-b analyses used to determine the compatibility of the 1st and 2nd scoring evaluations are shown in Tables 2 and 3. According to the analysis, there was a high level of correlation (r=0.896) and agreement (b=0.753) between the 1st and 2nd scoring of the Children Playing Drawing (p=0.000). Similarly, there was a high level of correlation (r=0.918) and agreement (b=0.773) between the 1st and 2nd Landscape Drawing scores (p=0.000).

Table 2 ***Harmony of the evaluators of the drawing of children at play***

	Correlation	Kendall's Tau b
Evaluation – Rater 1		
Coefficient	0.896	0.753
p	0.000*	0.000*
n	120	120

* $p < 0.05$

The correlation and Kendall's Tau-b analyses to determine the compatibility of the 1st scoring and 2nd scoring evaluations of the Children at Play Drawing are shown in the table. According to the analysis, there was a high level of correlation (r=0.896) and agreement (b=0.753) between the 1st and 2nd scorings of the Children Playing Drawing (p=0.000).

Table 3 ***Harmony of the evaluators of the landscape drawing***

	Correlation	Kendall's Tau b
Evaluation – Rater 1		
Coefficient	0.918	0.773
p	0.000*	0.000*
n	120	120

The correlation and Kendall's Tau b analyses to determine the compatibility of the 1st scoring and 2nd scoring evaluations of the Landscape Drawing are shown in the table. According to the analysis, there was a high level of correlation (r=0.918) and agreement (b=0.773) between the 1st and 2nd Landscape Drawing scores (p=0.000).

Ethical considerations: Permission and consent to conduct this research were obtained from the relevant institutions, schools, and the children's families.

3. Findings

Table 4 *Examining the age variability of scores*

	Age	n	Mean	SD	F
Evaluation – children playing	4 years old	51	18.78	5.83	6.786
	5 years old	37	21.91	4.54	
	6 years old	32	22.88	5.45	
Evaluation – Landscape Drawing	4 years old	51	18.29	5.57	12.313
	5 years old	37	20.72	5.27	
	6 years old	32	24.28	5.08	
Representational Drawing Success	4 years old	51	37.08	10.45	10.404
	5 years old	37	42.62	9.39	
	6 years old	32	47.16	9.82	

The results of the ANOVA test are presented in Table 4. According to the analysis, there were significant differences in scores for Children Playing (p=0.002), Landscape Drawing (p=0.000), and Representative Drawing Success (p=0.000). When the average scores were examined by age group, it was observed that children's success in representative drawing increased with age.

Table 5 *Examining the gender variation of scores*

	Gender	Average	SD	t	p
Rating – children playing	Girl	63	22.17	5.67	2.821 / p=0.006*
	Boy	57	19.36	5.21	
Evaluation – Landscape Drawing	Girl	63	21.91	5.73	2.574 / p=0.011*
	Boy	57	19.23	5.68	
Representational Drawing Success	Girl	63	44.09	10.71	2.890 / p=0.005*
	Boy	57	38.59	10.06	

The results of the t-test examining differences in scores by gender are shown in Table 5. According to the analysis, there were significant differences in scores for Playing Children (p=0.006), Landscape (p=0.011), and Representative Drawing Success (p=0.005) between girls and boys, with girls scoring higher than boys.

Table 6 *Comparison of representative drawing success with first-degree false belief success*

Representational Drawing Success	n	Average	SD	t	p
0 (Failed)	37	35.43	9.26	−4.431	0.000*
1 (Passed)	83	44.17	10.27		

According to the analysis, there was a significant difference between first-degree false beliefs and success in representative drawing (p=0.000). While the mean representative drawing success score of those who failed the first-degree false belief task was 35.43, the mean score of the children who passed was 44.17.

Table 7 *Comparison of representative drawing success with second-order false belief success*

Representational Drawing Success	n	Average	SD	t	p
0 (Failed)	77	38.44	9.41	−4.463	0.000*
1 (Passed)	43	46.91	10.90		

According to the analysis, there was a significant difference between second-degree false belief and success in representative drawing (p=0.000). While the mean score for those who failed the second-degree false belief task was 38.44, the mean score for those who passed was 46.91.

Table 8 *Comparison of representative drawing success with Faux Pas success*

Representational Drawing Success	n	Average	SD	t	p
0 (Failed)	102	40.16	9.94	−3.325	0.001*
1 (Passed)	18	48.92	12.22		

* $p < 0.05$

According to the analysis, there was a significant difference in the Representative Drawing Success of the achievements in the Faux Pas task (p=0.001). The mean score for those who failed the Faux Pas task was 40.16, whereas it was 48.92 for those who succeeded.

Table 9 *Investigation of the relationship between age and theory of mind tasks*

		4 years old n (%)	5 years old n (%)	6 years old n (%)	Chi-square / p
First-degree false belief	0 (Failed)	20 (39.2%)	9 (24.3%)	8 (25.0%)	χ^2=2.926, p=0.232
	1 (Passed)	31 (60.8%)	28 (75.7%)	24 (75.0%)	
Second-degree false belief	0 (Failed)	44 (86.3%)	18 (48.6%)	15 (46.9%)	χ^2=18.877, p=0.000*
	1 (Passed)	7 (13.7%)	19 (51.4%)	17 (53.1%)	

		4 years old n (%)	5 years old n (%)	6 years old n (%)	Chi-square / p
Faux Pas	0 (Failed)	51 (100.0%)	29 (78.4%)	22 (68.8%)	χ^2=16.900, p=0.000*
	1 (Passed)	0 (0.0%)	8 (21.6%)	10 (31.3%)	

The results of the chi-square test examining the relationship between age and theory-of-mind tasks are presented in Table 9. While there is no significant relationship between age and first-degree false belief (p=0.232), there is a significant relationship between second-degree false belief (p=0.000) and Faux Pas (p=0.000). As age increases, second-degree false belief and Faux Pas success increase.

Table 10 ***Investigation of the relationship between gender and theory of mind tasks***

		Girl n (%)	Boy n (%)	Chi-square / p
First-degree false belief	0 (Failed)	18 (28.6%)	19 (33.3%)	χ^2=0.318, p=0.573
	1 (Passed)	45 (71.4%)	38 (66.7%)	
Second-degree false belief	0 (Failed)	41 (65.1%)	36 (63.2%)	χ^2=0.001, p=0.977
	1 (Passed)	22 (34.9%)	21 (36.8%)	
Faux Pas	0 (Failed)	54 (85.7%)	48 (84.2%)	χ^2=0.000, p=1.000
	1 (Passed)	9 (14.3%)	9 (15.8%)	

There was no significant relationship between gender and first-degree false beliefs (p=0.573), second-degree false beliefs (p=0.977), and Faux Pas (p=1.000).

4. Discussion

This study aimed to determine whether there is an age-related relationship between preschool children's symbolic representations in drawings and their theory of mind (ToM) skills. The findings obtained from this study are discussed in light of existing literature.

The study revealed that children's scores on symbolic drawing increased with age (4, 5, and 6 years). This finding is consistent with the developmental literature (Malchiodi, 2013; Santrock, 2011) and with other studies (Gopnik & Slaughter, 1991; Kındap, 2004; Papandreou & Gousiou, 2020). Gopnik and Slaughter (1991) found that four-year-olds can report all their past mental states, including beliefs, compared to three-year-olds. Kındap (2004) determined that symbolic drawing achievement increases significantly with preschool age. Papandreou and Gousiou (2020) demonstrated that an increase in symbolic expression in children's drawings during the preschool period reflects the development of their mental representational capacity.

The findings also indicated that girls scored higher than boys on symbolic drawing tasks. Studies (Gardner, 1982; Kındap, 2004; Stuart, 1981, as cited in Malchiodi, 2013) show that girls perform better in symbolic representation tasks and that their more developed fine motor skills contribute to creating more realistic symbolic representations in their drawings.

This study also found a significant relationship between ToM skills (first-order false belief, second-order false belief, and faux-pas tasks) and success in symbolic drawing. This finding aligns with the literature, which considers symbolic representation as a foundational component of the theory of

mind (Walker & Murachver, 2012; Keskin, 2010). Research has shown that symbolic representations reflect not only cognitive development, but also social cognition (Lillard, 2021). Wimmer and Perner (1983) demonstrated that in tests of false beliefs and perspective-taking among children aged 3–9, children aged 4–6 show an emerging ability to represent the relationship between the mental states of two or more persons.

The findings showed that theory-of-mind skills improved with age. This finding fits the developmental framework proposed by Astington and Edward (2010). The results of studies by Flavell et al. (1992), Granti (2004), Ünlütabak (2012), and Cerrah-Özsevgeç and Kontaş (2015) with preschool children aged 3–5 support our findings. In this study, no significant difference was found between boys and girls in theory-of-mind performance. This result is consistent with the findings of similar studies (Arıkan & Tüfekçi, 2020; Ersoy, 2023; Güven et al., 2019; Kontaş, 2015). Baron-Cohen et al. (1999) also reported that girls performed significantly better than boys (approximately 2 years earlier) on advanced theory-of-mind tasks, such as faux pas, which may be linked to earlier development of language and social skills in girls (Kavanaugh & Engel, 2022).

4.1. Limitations and Future Directions

The limitations of this study are that the sample was restricted to children aged 4–6 attending public kindergartens in a region with similar socio-cultural characteristics, that children's Theory of Mind skills were evaluated according to symbolic representations in their drawings, and that the evaluation of symbolic representation scores in the development of theory of mind was examined according to gender. Future research may yield more comprehensive and generalizable results by including more age groups and considering theory-of-mind skills and variables. In longitudinal and wide-age-range studies, the development of symbolic representations can be examined across a broader age range. Studies conducted with groups of different cultural characteristics will allow comparisons of cultural contexts and theory-of-mind development.

4.2. Recommendations for Educators

Educational activities that support psychomotor, language, and emotional development should be planned and implemented for all children, regardless of their gender. Pretend play and artistic activities should be encouraged from infancy and early childhood onward to foster symbolic thinking and social understanding. Especially for preschool teachers, training should be organized to evaluate children's ToM development and implement supportive educational activities.

4.3. Conclusion

This study aimed to determine how the development of theory of mind in four-, five-, and six-year-old children varies with age, as reflected in their symbolic representations in drawings. The results showed that symbolic drawing scores of preschool children (4–6 years) increased with age, with girls scoring higher than boys. The study shows a significant correlation between theory-of-mind skills (first-order false belief, second-order false belief, and faux-pas tasks) and success in symbolic drawing. Theory of mind skills improve with age. Finally, there was no significant difference between boys and girls in theory-of-mind performance.

5. Declarations

5.1. Author Contributions (CRediT)

Hatice Darga: Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization; Project administration.

5.2. Conflict of Interest

The authors declare that they have no known competing financial interests, institutional affiliations, or personal relationships that could have appeared to influence the work reported in this paper.

5.3. Funding Statement

The authors declare they have not received specific financial support for the research.

5.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

5.5. Ethics Approval

This study was approved by the Ordu Governorship and Provincial Directorate of National Education (Approval Number: 8802389-44-E.14476266; Approval Date: 22.12.2016). After obtaining permission from the relevant authorities, discussions were held with the school administrators where the research would be conducted. Families were provided with explanatory information, and their consent was requested. Once the families gave their consent, the study commenced.

5.6. Use of Artificial Intelligence (AI) Tools

During the preparation of this work, we used [CHATGPT] on [JUNE 2025]. To save time, we edited the input flow, Method, and Introduction Section. Received help to translate. After using this tool/service, we reviewed and edited the content as needed and take full responsibility for the publication's content.

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An analysis of the science curriculum within the education model of the Türkiye century based on the SOLO taxonomy

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ABSTRACT

The science curriculum, updated in 2024, includes comprehensive reforms to promote interdisciplinary integration in teaching, develop higher-order thinking skills, and strengthen student-centered learning. Determining the extent to which these innovations reflect the cognitive depth of learning outcomes is strategically important for evaluating the curriculum's effectiveness in both its theoretical and practical dimensions. Within this framework, the SOLO Taxonomy provides an opportunity to objectively classify learning outcomes by structure, scope, and cognitive complexity, thereby revealing the cognitive profile of teaching programs in a detailed and systematic manner. In light of these considerations, this study aims to systematically analyze the learning outcomes for grades 3–8 in the 2024-updated science curriculum within the scope of the Türkiye Century Education Model, according to the SOLO taxonomy. The document review method, a qualitative research approach, was used in the study, and the 2024 science curriculum, published electronically by the Ministry of National Education, was examined as the data source. Descriptive analysis was employed to analyze the data obtained. The results indicated that the 585 learning outcomes for grades 3–8 within the curriculum were predominantly represented at the multistructural and relational stages, whereas the extended abstract stage was represented to a limited extent, and the unistructural stage to a very low extent. The expected gradual progression in cognitive development was not achieved across all grades when evaluated by grade levels, with some grades showing a decrease in higher-level cognitive structures and an increase in basic-level structures. This indicates that the curriculum has limitations in maintaining a balance between cognitive levels.

KEYWORDS: Science curriculum; SOLO taxonomy; Türkiye Century Education Model

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1. Introduction

Science, one of the core disciplines included in the education program, aims to equip students with the skills to understand natural phenomena, conduct research using scientific methods, and think critically (Güzel-Yüce & Koç, 2019). This discipline covers subfields such as physics, chemistry, biology, earth sciences, and astronomy, enabling students to learn about nature in its various dimensions and develop scientific process skills such as observation, experimentation, hypothesizing, data collection, and evaluation within the learning experience. It also strengthens problem-solving, creative thinking, and EBR skills, instilling lifelong learning habits. It enables

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theoretical knowledge to be applied to real-life contexts, thereby reinforcing values such as environmental awareness, sustainability, and scientific ethics (Harlen, 2010; Lederman, 2007) through its practical and experimental structure.

The fundamental aim of science education is to systematically and pedagogically transfer the knowledge and methods produced within the scientific discipline so that individuals can acquire scientific thinking skills and effectively apply this knowledge in their daily lives (Tan & Temiz, 2003). Effective science education supports students not only in acquiring knowledge but also in becoming individuals with the skills to question, solve problems, and adapt to innovations. In this context, science education not only improves individuals' quality of life but also significantly contributes to social and sustainable development (Çepni, 2014). In addition, scientific literacy acquired through science education enables individuals to make decisions based on scientific knowledge and approach technological developments with a critical perspective (Çevik & Kaya, 2021). Thus, it helps lay the foundations necessary for developing conscious and responsible behavior at the individual and social levels. The achievement of science education goals and the effective acquisition of scientific process skills by students depend on implementing a science curriculum aligned with these objectives, kept up to date, and grounded in scientific foundations. The science curriculum includes objectives for students related to the field of science; content structured in line with the intended outcomes; activities to be implemented; methods and tools; and assessment criteria that indicate the extent to which the objectives have been achieved (Bümen, 2006).

As of 2024, the science curriculum in Türkiye has been updated and integrated into educational and teaching processes within the framework of the Türkiye Century Education Model. This model aims to develop scientific thinking skills, raise environmental awareness, and instill a consciousness of sustainable living in students (MEB, 2025). The Türkiye century education model aims to restructure Türkiye's education system to meet the requirements of the 21st century by integrating national and cultural values with modern science and technology, and by promoting reforms in educational opportunity, digitalization, research, and professional development. The model aims to develop students into innovative, creative individuals who can adapt to global competition, thereby playing a central role in sustainable development and global success (Diktaş et al., 2025). When examining the innovations brought by this model, it is expected that it will make a significant contribution to the process of preparing individuals for the 21st century, particularly in the field of science education, by presenting literacy skills as a clear and systematic set of competencies, emphasizing the importance of skills, values, and literacy, and adopting a guiding approach on how to integrate them into life (Bilir, 2025). Indeed, it has been emphasized that adopting a skill-based approach, creating a student model with virtues and competencies, and incorporating the virtues-values-actions model into the curriculum are highly valuable for educating students for the 21st century (Yıldırım & Çalışkan, 2024).

The curriculum guides the teaching process and clarifies assessment criteria by using taxonomy models that hierarchically classify cognitive levels to systematically and measurably determine student learning outcomes (Avcı et al., 2021). In this context, the SOLO taxonomy provides an effective tool for assessing the quality of learning outcomes at the prestructural, unistructural, multistructural, relational, and extended abstract stages, revealing the depth and complexity of the learning outcomes of curriculum and thus enriching the design and implementation of curriculum to include not only the acquisition of knowledge but also its interpretation and application to new situations (Biggs & Collis, 1982).

At the prestructural stage, the first level of the SOLO taxonomy, students have not developed a meaningful understanding, and their knowledge is scattered and disorganized; therefore, their

knowledge is insufficient to enable them to reach the correct conclusion (Brabrand & Dahl, 2009). The unistructural stage is the second level of the SOLO taxonomy, and at this level, students approach their achievements and knowledge from only one perspective; that is, they try to understand concepts by focusing on a specific aspect of the question or information presented to them (Lister et al., 2006). The multistructural stage is the third level in the SOLO taxonomy. At this stage, the subject is presented to the student in a way that allows it to be approached from different angles, and the student can evaluate various aspects without establishing connections among the subjects (Gezer & İlhan, 2015). The relational stage constitutes the fourth level of the SOLO taxonomy, and at this stage, students can integrate the parts into a whole by establishing meaningful connections between the knowledge presented to them, and they can also develop an in-depth understanding by establishing cause-and-effect relationships between pieces of knowledge (Biggs & Collis, 1982). The extended abstract stage represents the highest and final stage of the SOLO taxonomy; at this stage, students can structure the knowledge they have learned at a metacognitive level and develop creative and original ideas based on existing knowledge (Lake, 1999). In addition, to determine the level of each stage in the SOLO taxonomy, except for the prestructural step, Biggs (2003) and Burnett (1999) defined indicator verbs (Gezer & İlhan, 2014).

2. Literature Review

In the literature, studies have been conducted based on the SOLO taxonomy. For example, Dönmez and Zorluoğlu (2020) examined the learning outcomes for grades 6, 7, and 8 in the 2018 middle school science curriculum within the SOLO taxonomy framework. Their analysis indicated that most learning outcomes were at the uni-structural and relational levels, whereas the multi-structural and extended abstract levels were less prevalent. Cihan and Doruk (2024) analyzed the 2024 secondary school mathematics curriculum according to the SOLO taxonomy and cognitive demand levels. Their findings showed that the curriculum's learning outcomes were predominantly at the extended-abstract level, followed by the relational, multi-structural, and uni-structural levels. Korkmaz and Ünsal (2017) examined 11th-grade learning outcomes and assessment questions in the 2010 Sociology Curriculum using the SOLO Taxonomy. Their results revealed that both learning outcomes and assessment questions covered all SOLO levels, with the outcomes concentrated primarily at the relational and uni-structural levels and the assessment questions primarily at the uni-structural and multi-structural levels. Doğan (2020) analyzed the 2018 elementary school mathematics curriculum learning outcomes of 2018 based on the SOLO taxonomy. The findings indicated that most outcomes were at the uni-structural and multi-structural levels, few were relational, and none were at the extended abstract level. Ağçam and Babanoğlu (2018) examined learning outcomes in the 2018 English curriculum for primary and secondary education using the SOLO Taxonomy. Their results showed that outcomes were predominantly at the uni- and multi-structural levels in primary education and at the multi- and relational levels in secondary education, indicating that the programs focused more on lower-order cognitive skills. Brabrand and Dahl (2009) used the SOLO Taxonomy to analyze the learning outcomes of undergraduate and graduate science programs at the Faculties of Science at Aarhus University and the University of Southern Denmark in 2007. Their findings revealed a clear progression in competence from undergraduate to graduate levels and highlighted the strong influence of educational traditions and subjects on program structures. Erbudak (2025) examined the measurement and assessment questions in 4th–7th-grade social studies textbooks used in primary and secondary schools in Turkey during the 2024–2025 academic year, using the SOLO Taxonomy. The study found that most questions were at the uni-structural level; the fewest were at the extended

abstract level; relational and multi-structural questions were limited in number; and there was no significant change in the cognitive level of questions as the grade level increased.

3. Purpose and Significance of the Study

The primary aim of this study is to systematically analyze the learning outcomes for grades 3–8 in the 2024 revised Science Curriculum according to SOLO levels. In addition, this study aims to determine the cognitive complexity levels of the curriculum's learning outcomes, reveal their distribution across grade levels and content areas, and provide insights into how this distribution could foster higher-order thinking skills in students. The 2024 Science Curriculum includes significant changes designed to promote interdisciplinary integration in teaching processes, enhance higher-order thinking skills, and strengthen SCL approaches. Determining the extent to which these changes are reflected in the cognitive depth of learning outcomes is a strategic necessity for evaluating the curriculum's effectiveness in both theoretical and practical dimensions. Furthermore, systematically examining the grade-level learning outcomes of the previous curriculum in terms of both their current SOLO taxonomy levels and the ideal SOLO levels expected of students will enable a more comprehensive assessment of the effects of curriculum changes on cognitive complexity and higher-order thinking skills.

The SOLO Taxonomy enables the objective classification of learning outcomes by structure, scope, and cognitive complexity, thereby providing a detailed profile of curricula's cognitive characteristics. A review of the existing literature indicates that no study has analyzed the 2024 revised curriculum based on the SOLO taxonomy. In this context, beyond addressing a significant gap in the literature, the study is expected to provide comprehensive, concrete, measurable, and comparable data to curriculum developers, educators, and researchers, thus laying a scientifically grounded foundation for both curriculum development and the improvement of educational practices. Furthermore, serving as an effective guide across a wide spectrum—from policy-making processes to classroom practices—this research represents a pioneering study that provides a reference framework for understanding and enhancing the curriculum's cognitive architecture at both theoretical and practical levels.

In line with these considerations, the learning outcomes in the 2024 science curriculum, developed within the scope of the Türkiye Century Education Model, were examined using the SOLO taxonomy, and the following questions were addressed.

- How are the science curriculum learning outcomes distributed according to the SOLO taxonomy?
- How are the 3rd-grade learning outcomes distributed according to the SOLO taxonomy?
- How are 4th-grade learning outcomes distributed according to the SOLO taxonomy?
- How are 5th-grade learning outcomes distributed according to the SOLO taxonomy?
- How are 6th-grade learning outcomes distributed according to the SOLO taxonomy?
- How are 7th-grade learning outcomes distributed according to the SOLO taxonomy?
- How are the 8th-grade learning outcomes distributed according to the SOLO taxonomy?

4. Method

4.1. Research Design

The document review method, a qualitative research approach, was employed in this study. Document review is a qualitative method that systematically and meticulously examines the content of written materials to obtain comprehensive and in-depth knowledge of a particular subject (Bowen, 2009). This method, which allows the evaluation of both printed and electronic sources, contributes to the construction of meaning, the development of a conceptual framework, and the production of empirical knowledge (Corbin & Strauss, 2008). In this context, document review goes beyond merely providing a superficial description of existing data, encompassing the information's interpretation and contextualization.

4.2. Study Sample

In this study, the Science Curriculum, which was updated in 2024 within the framework of the Türkiye Century Education Model and published electronically by the Ministry of National Education (MEB), the institution responsible for preparing and publishing curricula in Türkiye, was examined. Within the scope of the study, the https://tymm.meb.gov.tr website was accessed, the science course was selected from the curriculum section, and a total of 585 learning outcomes from the units at the 3rd–8th grade levels were identified.

4.3. Data Analysis

Descriptive analysis was employed to examine the data. Descriptive analysis is a qualitative research method that systematically organizes and interprets data within the framework of predetermined themes (Yıldırım & Şimşek, 2018). In this approach, the data obtained are grouped under meaningful themes, described with direct quotations, and presented within an interpretive framework (Miles & Huberman, 1994). During the analysis, all findings were first categorized by grade level and related units, and recorded in Microsoft Excel. Each learning outcome was evaluated by the SOLO stage it corresponded to and classified by content. To ensure reliability, the opinions of two experts, one in the field of social studies education and the other in the field of science education, were sought, both of whom had previously conducted analyses related to the SOLO taxonomy. The study's reliability was calculated using the formula developed by Miles and Huberman (1994): [Reliability = Agreement / (Agreement + Disagreement) × 100]. The result was 94.4%, indicating that the analyses were highly reliable. The SOLO levels corresponding to the learning outcomes for each grade level were identified, and the findings were presented graphically and interpreted descriptively. Within this framework, the analysis provided insights into the curriculum's cognitive competence levels within the scope of the Türkiye Century Education Model, systematically revealing the structural depth and developmental stages of the curriculum's learning outcomes. The indicator verbs identified in the studies by Biggs (2003) and Brabrand & Dahl (2009) were used to classify the learning outcomes according to the SOLO taxonomy. Table 1 presents the distribution of these indicator verbs across the SOLO stages.

Table 1 *Indicator Verbs Defined for the SOLO Taxonomy Stages*

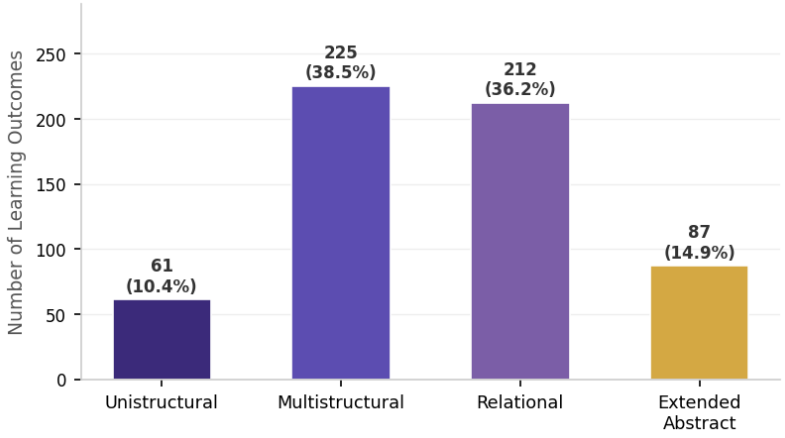
Unistructural	Multistructural	Relational	Extended Abstract
Memorize Identify Recognize Count Define Draw Find Label Match Name / Quote Recall Recite Follow a simple command Arrange / Decide Note / Seek Choose / Sketch Pick / Order	Classify Describe List Report Discuss Illustrate Select Narrate Compute Sequence / Outline Separate Combine Account for / Apply Method / Execute make / Use method Solve / Conduct Prove / Complete Process / Report Express / Characterize	Applying a given theory to a related field Conclude Integrate Summarize Analyze Review Explaining the causes Argue / Predict Transfer Substantiate Construct Exemplify Design / Derive Adapt / Structure Make a plan / Relate Implement / Compare Contrast / Differentiate Organize / Debate Make a case / Construct Review and rewrite / Examine Paraphrase / Translate Solve a problem / Question Argue	Theorize Hypothesize Generalize Create Generate Compose Invent Originate / Creating an original case Prove from the first principle Solve from the first principle Reason Reflect Imagine / Evaluate Assess / Interpret Reflect / Perspectivate Criticize / Judge

5. Findings

5.1. Distribution of Science Curriculum Learning Outcomes According to the SOLO Taxonomy

The distribution of the 585 learning outcomes in the science curriculum, according to the SOLO taxonomy, is shown in Figure 1.

Figure 1 *Distribution of Science Curriculum Learning Outcomes According to the SOLO Taxonomy*

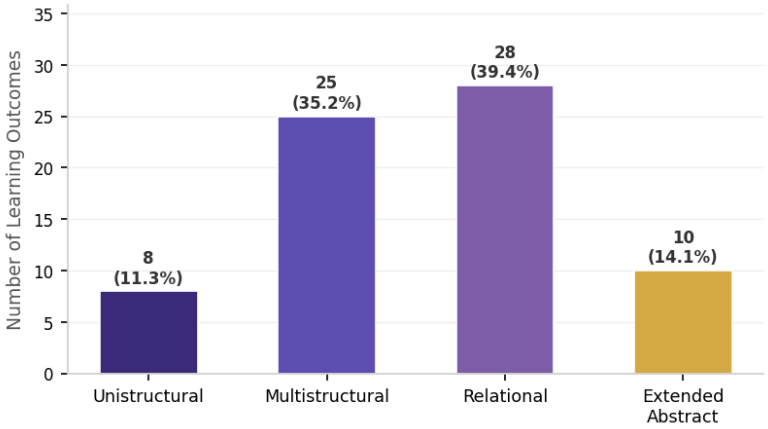


As shown in Figure 1, 61 of the learning outcomes (10.4%) are unistructural, 225 (38.5%) are multistructural, 212 (36.2%) are relational, and 87 (14.9%) are extended abstract.

5.2. Distribution of 3rd Grade Learning Outcomes According to the SOLO Taxonomy

The distribution of 71 learning outcomes at the 3rd grade level according to the SOLO taxonomy is shown in Figure 2.

Figure 2 ***Distribution of 3rd-Grade Learning Outcomes According to SOLO Taxonomy***



As shown in Figure 2, 8 (11.3%) of the 3rd-grade learning outcomes were unistructural, 25 (35.2%) were multistructural, 28 (39.4%) were relational, and 10 (14.1%) were extended abstract. For illustrative purposes, Table 2 presents the 3rd-grade learning outcomes, the corresponding SOLO taxonomy stages, and their justifications.

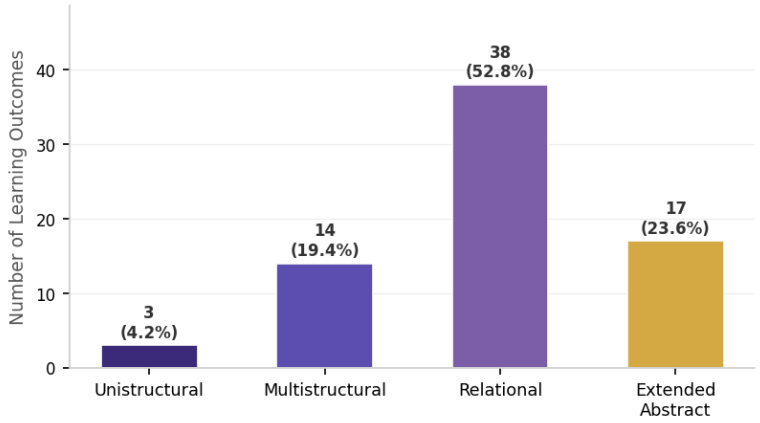
Table 2 ***Selected Examples from 3rd Grade Learning Outcomes, SOLO Taxonomy Levels, and Justifications***

Unit	Learning Outcomes	SOLO Stages	Justifications
The Scientific Discovery Journey	FB.3.1.2.a: He/she gathers knowledge about scientists.	Unistructural	This learning outcome was assessed at the unistructural stage because it only involves the ability to gather knowledge and does not require association or analysis.
Journey to the Living World	FB.3.2.1.c: He/she groups living things.	Multistructural	This learning outcome has been evaluated at a multistructural stage because it involves classifying living things according to multiple characteristics and using multiple pieces of knowledge.
Geoscientists in Action	FB.3.3.2.b: He/she establishes relationships between the stages of the process.	Relational	This learning outcome has been assessed at the relational stage because it involves developing a holistic understanding by establishing relationships between the stages of the process.
Let's Get to Know the Substance, Mix, and Separate	FB.3.4.2.a: He/she designs experiments related to methods that can be used to separate mixtures.	Extended Abstract	This learning outcome was assessed at the extended abstract stage, as it involves adapting knowledge to a new situation and abstracting when designing experiments using methods for separating mixtures.

5.3. Distribution of 4th Grade Learning Outcomes According to the SOLO Taxonomy

The distribution of 72 learning outcomes at the 4th grade level according to the SOLO taxonomy is shown in Figure 3.

Figure 3 ***Distribution of 4th-Grade Learning Outcomes According to SOLO Taxonomy***



As shown in Figure 3, 3 of the 4th-grade achievements (4.2%) are unistructural, 14 (19.4%) are multistructural, 38 (52.8%) are relational, and 17 (23.6%) are extended abstract. For illustrative purposes, Table 3 shows the 4th-grade learning outcomes and the corresponding SOLO taxonomy stages and justifications.

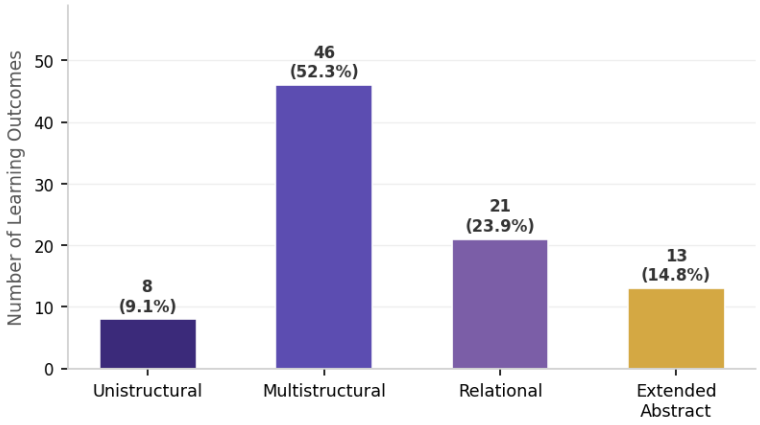
Table 3 ***Selected Examples from 4th Grade Learning Outcomes, SOLO Taxonomy Levels, and Justifications***

Unit	Learning Outcomes	SOLO Stages	Justifications
Transformation of Matter	FB.4.4.1.b: Records data related to substance transformation.	Unistructural	This achievement has been evaluated at an unistructural stage because it involves the student recording data on the transformation of substances and does not require establishing relationships or performing analysis.
I Eat Healthily	FB.4.2.2.b: Identifies the common characteristics of foods.	Multistructural	This learning outcome has been assessed at a multistructural stage because it involves the student identifying multiple common characteristics in foods and using multiple pieces of knowledge.
The Journey to Science	FB.4.1.1.c: Evaluates the conclusions reached regarding the scientific characteristics.	Relational	This learning outcome has been assessed at the relational stage because it involves the student analyzing and evaluating conclusions reached regarding the characteristics of science.
Discovering Magnets	FB.4.5.3.b: Develops a model that can be used to answer a question or problem.	Extended Abstract	This learning outcome was evaluated at the extended abstract stage because it involves adapting knowledge to a different situation by developing a new model that can be used to answer the student's question or problem.

5.4. Distribution of Learning Outcomes in the 5th Grade According to the SOLO Taxonomy

The distribution of 88 learning outcomes at the 5th grade level according to the SOLO taxonomy is shown in Figure 4.

Figure 4 ***Distribution of 5th-Grade Learning Outcomes According to SOLO Taxonomy***



As shown in Figure 4, 8 (9.1%) of the 5th grade learning outcomes were unistructural, 46 (52.3%) were multistructural, 21 (23.9%) were relational, and 13 (14.8%) were extended abstract. For illustrative purposes, Table 4 shows the 5th grade learning outcomes and the corresponding SOLO taxonomy stages and justifications.

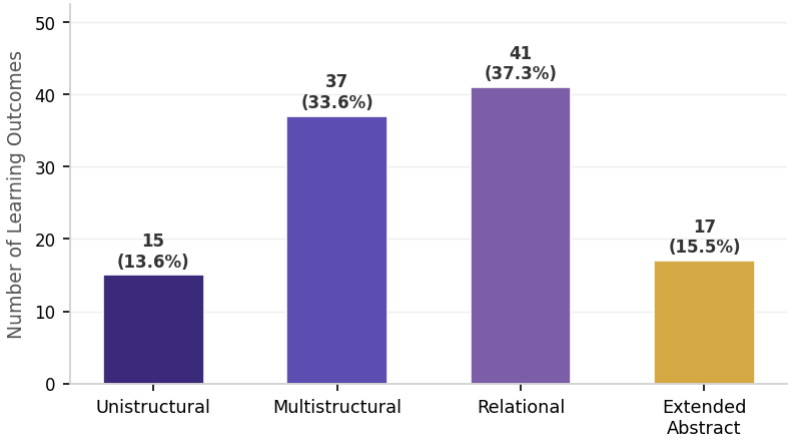
Table 4 ***Selected Examples from 5th Grade Learning Outcomes, SOLO Taxonomy Levels, and Justifications***

Unit	Learning Outcomes	SOLO Stages	Justifications
Neighbors in the Sky and Us	FB.5.1.2.1.b: He/she records data on the characteristics of the Moon and its rotational and orbital movements.	Unistructural	This learning outcome has been assessed at a unistructural stage because it involves the student recording data on the characteristics of the Moon and its rotational and orbital movements, and it does not require the student to establish relationships or perform analysis.
Let's Get to Know the Force	FB.5.2.2.1.a: He/she defines the mass and weight properties.	Multistructural	This learning outcome has been assessed at a multistructural stage because it involves the student defining multiple characteristics related to the concepts of mass and weight.
Nature of the Substance	FB.5.5.3.1.b: Compares observations- and non-observations-based propositions.	Relational	This learning outcome is assessed at the relational level, as it requires the student to compare and relate observation- and non-observation-based propositions.
Electricity in our lives	FB.5.6.1.2.a: He/she designs an experimental system that matches the electrical circuit he/she has drawn.	Extended Abstract	This learning outcome was evaluated at an extended abstract stage because it involves the student adapting their knowledge to a new situation by designing an experimental setup appropriate to the electrical circuit they have drawn.

5.5. Distribution of 6th Grade Learning Outcomes According to the SOLO Taxonomy

The distribution of 110 learning outcomes at the 6th grade level according to the SOLO taxonomy is shown in Figure 5.

Figure 5 ***Distribution of 6th-Grade Learning Outcomes According to SOLO Taxonomy***



As shown in Figure 5, 15 of the 6th grade learning outcomes (13.6%) are unistructural, 37 (33.6%) are multistructural, 41 (37.3%) are relational, and 17 (15.5%) are extended abstract. For illustrative purposes, Table 5 shows the 6th grade learning outcomes and the corresponding SOLO taxonomy stages and justifications.

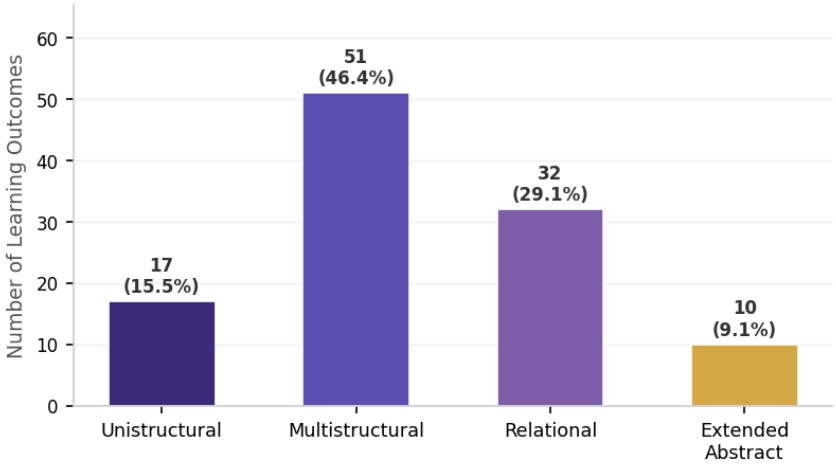
Table 5 ***Selected Examples from 6th Grade Learning Outcomes, SOLO Taxonomy Levels, and Justifications***

Unit	Learning Outcomes	SOLO Stages	Justifications
Solar System and Eclipses	FB.6.1.2.1.b: He/she records data collected during solar and lunar eclipses.	Unistructural	This learning outcome has been assessed at an unistructural stage because it involves the student recording data related to solar and lunar eclipses and does not require establishing relationships or performing analysis.
Influence of Force	FB.6.2.2.1.a: Determines the characteristics related to the speed and velocity concepts.	Multistructural	This learning outcome has been assessed at a multistructural stage because it involves students identifying multiple characteristics related to the concepts of speed and velocity.
Systems in Living Things	FB.6.3.1.4.c: Data on the basic factors affecting reproduction, growth, and development in animals are evaluated.	Relational	This learning outcome has been assessed at the relational stage because it involves the student analyzing data related to the basic factors affecting animal reproduction, growth, and development.
Lighting and Colors	FB.6.4.3.4.b: Reasoning about innovative applications of solar energy in daily life and technology.	Extended Abstract	This learning outcome was assessed at an extended abstract stage because it involves the student using knowledge in a new context by reasoning about innovative applications of solar energy in everyday life and technology.

5.6. Distribution of 7th Grade Learning Outcomes Based on the SOLO Taxonomy

The distribution of 110 learning outcomes at the 7th grade level according to the SOLO taxonomy is shown in Figure 6.

Figure 6 ***Distribution of 7th-Grade Learning Outcomes According to the SOLO Taxonomy***



As shown in Figure 6, 17 of the 7th-grade learning outcomes (15.5%) were unistructural, 51 (46.3%) were multistructural, 32 (29.1%) were relational, and 10 (9.1%) were extended abstract. For illustrative purposes, Table 6 presents the 7th-grade learning outcomes, the corresponding SOLO taxonomy stages, and their justifications.

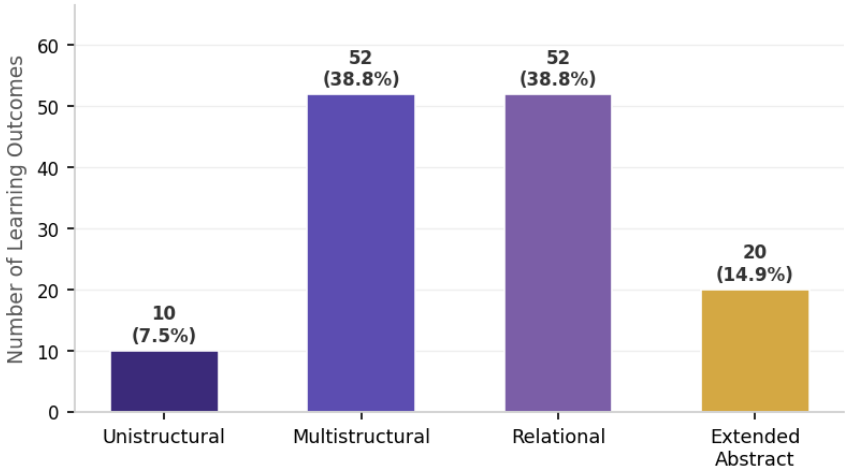
Table 6 ***Selected Examples from 7th Grade Learning Outcomes, SOLO Taxonomy Levels, and Justifications***

Unit	Learning Outcomes	SOLO Stages	Justifications
A Journey into the Nature of Substances	FB.7.5.1.2.c: He/she gathers knowledge about atoms from the past to the present.	Unistructural	This learning outcome has been evaluated at an unistructural stage because it involves the student gathering knowledge about atoms from the past to the present and does not require establishing connections or performing analysis.
Refraction of the Light and Lenses	FB.7.4.2.2.c: He/she groups the areas of lens application.	Multistructural	This learning outcome has been evaluated at a multistructural stage because it involves the student categorizing the areas of lens application according to multiple characteristics.
Electrification	FB.7.6.1.1.c: Verifies the knowledge he has about electrification.	Relational	This learning outcome has been evaluated at the relational stage because it involves the student evaluating the accuracy of the knowledge they have found about electrification.
Sustainable living and recycling	FB.7.7.2.1.b: He/she develops models to find solutions for the efficient use of resources.	Extended Abstract	This learning outcome was assessed at an extended abstract stage because it involves the student adapting knowledge to a new situation by developing a model to find solutions for the economical use of resources.

5.7. Distribution of 8th Grade Learning Outcomes According to the SOLO Taxonomy

The distribution of 134 learning outcomes at the 8th grade level according to the SOLO taxonomy is shown in Figure 7.

Figure 7 ***Distribution of 8th-Grade Learning Outcomes According to SOLO Taxonomy***



As shown in Figure 7, 10 of the 8th-grade learning outcomes (7.5%) are unistructural, 52 (38.8%) are multistructural, 52 (38.8%) are relational, and 20 (14.9%) are extended abstract. For illustrative purposes, Table 7 presents the 8th-grade learning outcomes, the corresponding SOLO taxonomy stages, and their justifications.

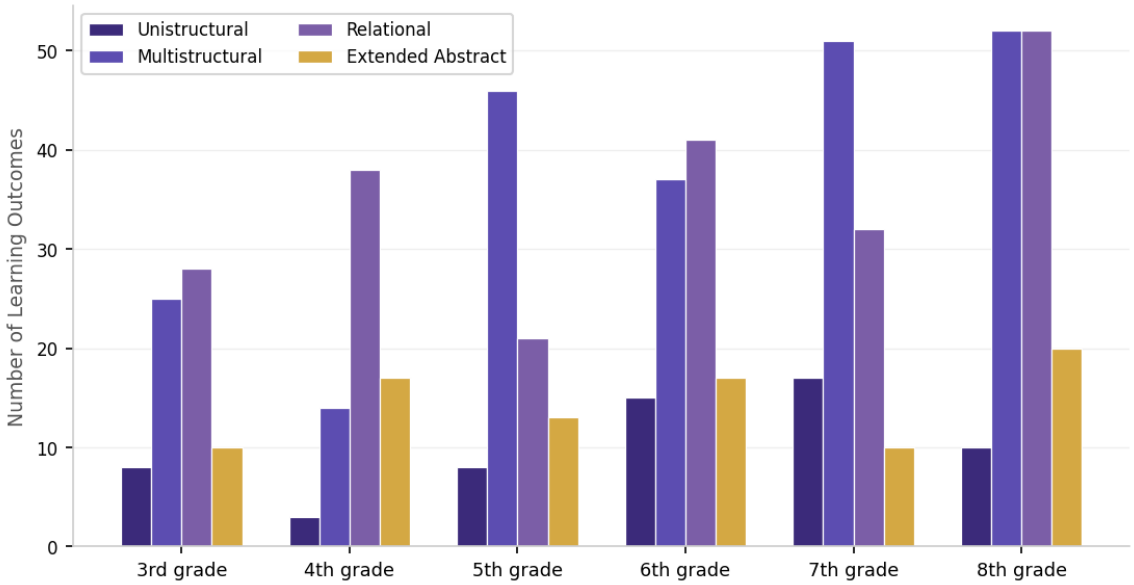
Table 7 ***Selected Examples from 8th Grade Learning Outcomes, SOLO Taxonomy Levels, and Justifications***

Unit	Learning Outcomes	SOLO Stages	Justifications
The Mystery of Life	FB.8.3.4.1.b: He/she finds knowledge about mutation.	Unistructural	This learning outcome has been assessed at an unistructural stage because it involves the student finding knowledge about mutation and does not require establishing connections or performing analysis.
The Force that Makes Life Easier	FB.8.2.1.1.a: Determines the characteristics of the simple machines.	Multistructural	This learning outcome has been assessed at a multistructural stage because it involves the student using multiple pieces of knowledge by identifying multiple attributes, such as the functions and characteristics of simple machines.
The Sound World	FB.8.4.1.2.b: He/she analyzes data obtained by observing how the same sound is heard differently in different environments.	Relational	This learning outcome was assessed at the relational stage because it involves the student analyzing observational data related to how the same sound is perceived differently in different environments and establishing relationships between the data.
Periodic Table and the Interaction of Substances	FB.8.5.4.4.a: He/she designs experiments to demonstrate the effects of acids and bases on various substances.	Extended Abstract	This learning outcome was assessed at an extended abstract stage because it involved the student adapting their knowledge to a new situation by designing an experiment to demonstrate the effects of acids and bases on various substances.

5.8. Distribution of Science Curriculum Outcomes by Grades According to SOLO Taxonomy

The distribution of 585 learning outcomes according to SOLO taxonomy by grades is shown in Figure 8.

Figure 8 ***Distribution of Learning Outcomes by Grades According to SOLO Taxonomy***



6. Discussion, Conclusion, and Recommendations

6.1. Discussion and Conclusion Regarding the First Sub-Problem

When examining the distribution of 585 learning outcomes according to the SOLO taxonomy, the highest proportion was in the multistructural category (38.5%), followed by the relational (36.2%), the extended abstract (14.9%), and the unistructural (10.4%). These results indicate that the curriculum includes learning outcomes that can assess students' cognitive skills from multiple perspectives and enable them to organize knowledge relationally. The combined presence of multi-structural and relational levels at 74.7% demonstrates that the curriculum is focused on intermediate- and higher-order cognitive levels. However, the relatively limited proportion of learning outcomes at the extended-abstract level suggests that students' potential to develop higher-order competencies, such as knowledge restructuring, critical thinking, creative problem-solving, and applying knowledge to new situations, is restricted. The low proportion of uni-structural outcomes (10.4%) suggests that basic knowledge outcomes are kept limited, which may hinder progression to higher-order cognitive levels without a solid understanding of fundamental concepts. In a similar study, Sağlamöz and Soysal (2021) analyzed the 2018 primary school science curriculum outcomes based on the revised Bloom's Taxonomy and indicated that outcomes at the remembering and understanding levels required "low" cognitive demand, those at the applying and analyzing levels required "medium" demand, and those at the evaluating and creating levels required "high" cognitive demand. The highest proportion, 39.82%, was found in the understanding dimension. These data indicate that both curricula primarily target intermediate- and higher-order cognitive processes, although the relatively low proportion at the highest cognitive levels suggests limited potential for developing advanced skills.

The SOLO taxonomy allows learning outcomes to be classified not only in terms of cognitive processes but also based on the structural complexity and qualitative depth of knowledge, revealing students' potential to establish inter-conceptual relationships, integrate knowledge, and develop higher-order thinking skills (Biggs & Collis, 1982). In contrast, the revised Bloom's Taxonomy focuses on the hierarchical ordering of cognitive processes but offers limited opportunities to systematically assess the structural integrity of knowledge and its applicability across contexts (Anderson &

Krathwohl, 2001). In this respect, the SOLO Taxonomy offers a more comprehensive and robust framework for analyzing the extent to which the curriculum includes relational and extended abstract outcomes representing higher-order cognitive processes and the potential for students to develop critical, creative, and problem-solving skills.

6.2. Discussion and Conclusion Regarding the Second Sub-Problem

When examining the learning outcomes of the 3rd grade, the highest proportion was relational (39.4%), followed by multistructural (35.2%), extended abstract (14.1%), and unistructural (11.3%). The fact that the unistructural learning outcomes, representing basic cognitive processes, remain at this level in 3rd grade, the starting level of science education, suggests deficiencies in establishing a solid foundation for students' learning. This situation may indicate that students are not adequately supported, especially in the stages of recognizing basic concepts and acquiring knowledge for the first time. Conversely, the high proportions of relational and multistructural stages indicate that the curriculum tends to guide students toward more complex thinking processes at early stages. However, this approach may make it difficult to transition to higher-order cognitive processes without adequately reinforcing basic cognitive skills. Therefore, increasing the number of unistructural learning outcomes in 3rd grade is important to ensure the learning process is grounded in a solid foundation.

In a similar study, Karakuyu (2021) analyzed 3rd-grade outcomes of the 2018 science curriculum using the Haladyna taxonomy. The analysis revealed that 57.58%, 6.06%, and 30.30% of the learning outcomes were categorized in the comprehension and problem-solving stages, 30.30% in the critical-thinking stage, and 6.06% in the creativity stage. Accordingly, the 3rd-grade learning outcomes address lower-order cognitive skills such as comprehension and problem-solving, which is appropriate considering the age and developmental characteristics of 3rd-grade students. From this perspective, a clear distinction is observed between the findings of this study and those of Karakuyu (2021). The increase in the proportion of learning outcomes focused on higher-order cognitive processes at the 3rd-grade level in the 2024 Science Curriculum aligns with the contemporary educational approach that seeks to develop complex thinking skills at an early age. However, advancing to higher-order cognitive processes without adequately reinforcing basic-level conceptual knowledge and skills can increase students' cognitive load and lead to conceptual gaps in learning. Therefore, structuring the curriculum to develop both basic and higher-order skills in a balanced manner is critical for holistically supporting students' cognitive development.

6.3. Discussion and Conclusion Regarding the Third Sub-Problem

When examining the learning outcomes for 4th grade, the highest proportion was relational (52.8%), followed by extended abstract (23.6%), multistructural (19.4%), and unistructural (4.2%). Compared to the 3rd-grade learning outcomes, those at the relational stage increased significantly from 39.4% to 52.8%, and those at the extended abstract stage rose from 14.1% to 23.6%. In contrast, the learning outcomes at the multistructural stage decreased from 35.2% to 19.4%, and those at the unistructural stage declined from 11.3% to 4.2%. This indicates that students have made significant progress in higher-order thinking skills. However, the fact that learning outcomes at the unistructural stage, which represent basic cognitive processes, remain at a very low rate of 4.2% raises concerns about whether the fundamental building blocks of learning are sufficiently emphasized. Especially in the early stages of subjects such as science, where conceptual foundations play a critical role, students must establish a solid learning foundation by presenting basic knowledge and skills in a balanced and systematic manner. In this context, the curriculum should provide a more balanced distribution of learning outcomes across different cognitive levels. In their study, Doğan and Burak (2018) examined

46 learning outcomes at the 4th-grade level in the 2013 science curriculum, using the revised Bloom's taxonomy, and reported that the comprehension and application levels were predominant, whereas higher-order cognitive processes, such as analysis and evaluation, were more limited. In this regard, the finding that the 4th-grade learning outcomes in the present study were most frequently at the relational stage, compared with Doğan and Burak (2018), indicates that the 2024 updated curriculum places a marked emphasis on higher-order cognitive objectives. However, the low proportion of learning outcomes at the unistructural stage suggests that the basic knowledge and comprehension stages are insufficiently reinforced. As emphasized in the literature (Doğan & Burak, 2018; Biggs & Collis, 2014), a gradual transition from lower- to higher-order cognitive processes is critical for learning sustainability. Therefore, while the curriculum strengthens higher-order cognitive objectives, lower-order cognitive structures should not be overlooked.

6.4. Discussion and Conclusion Regarding the Fourth Sub-Problem

When examining the learning outcomes of 5th grade, it was determined that the highest proportion was in the multistructural category (52.3%), followed by the relational (23.9%), extended abstract (14.8%), and unistructural (9.1%). Compared to the 4th grade, the learning outcomes at the multistructural stage increased significantly from 19.4% to 52.3%. In contrast, the learning outcomes at the relational stage decreased from 52.8% to 23.9%, and those at the extended abstract stage declined from 23.6% to 14.8%. In addition, the learning outcomes at the unistructural stage increased from 4.2% to 9.1%. The reduction in relational and extended abstract outcomes, which represent higher-order cognitive processes, is noteworthy in light of expectations for cognitive development. While an increase in these outcomes is expected as grade level progresses, the concentration of multistructural outcomes and the rise in unistructural outcomes in 5th grade indicate inconsistencies in the curriculum's cognitive development sequence. In a similar study, Ozcan and Kaptan (2019) examined the 2018 science curriculum according to the revised Bloom's taxonomy. The analysis showed that 20% of the learning outcomes were in the knowledge dimension, 22.8% in comprehension, 2.9% in problem-solving, 51.4% in scientific process skills, 2.9% in the science-technology-society-environment domain, and 0% in attitudes and values at the 5th grade level. Considering these two findings together, it can be observed that in the 2024 science curriculum, 5th-grade learning outcomes are predominantly at the multistructural stage according to the SOLO taxonomy, whereas in the 2018 science curriculum at the same grade level, they were mostly concentrated in the scientific process skills domain according to the revised Bloom's taxonomy. The multistructural stage aligns with scientific process skills by requiring the integration of multiple pieces of information; however, the decline in higher-order cognitive processes, such as the relational and extended abstract stages, indicates that students' ability to achieve deep understanding and to apply knowledge across contexts is insufficiently supported. Therefore, the predominance of middle-order cognitive processes in the structure of the curriculum's learning outcomes limits the development of higher-order structures, resulting in deviations from the expected upward trajectory in the cognitive progression hierarchy.

6.5. Discussion and Conclusion Regarding the Fifth Sub-Problem

When examining the learning outcomes of 6th grade, it was determined that the highest proportion was relational (37.3%), followed by multistructural (33.6%), extended abstract (15.5%), and unistructural (13.6%). The learning outcomes at the relational stage increased significantly from 23.9% to 37.3% compared with the 5th grade. The outcomes at the multistructural stage decreased markedly from 52.3% to 33.6%, whereas those at the extended abstract stage rose slightly from 14.8% to 15.5%. However, the outcomes at the unistructural stage increased from 9.1% to 13.6%,

contradicting the expected decrease in cognitive development. In this context, the increase in the rate of unistructural outcomes in the 6th-grade curriculum suggests that learning outcomes are concentrated in basic cognitive processes and that higher-order thinking skills are not supported at the expected level. In a similar study, Cangüven et al. (2017) examined the 2017 draft science curriculum according to Bloom's revised taxonomy. Based on their analysis, the 6th-grade learning outcomes were distributed across the remembering, understanding, application, analysis, and evaluation levels of the cognitive domain at 11%, 40%, 20%, 7%, and 3%, respectively. Accordingly, a parallel exists between the findings of both curricula within the framework of different taxonomies. Both studies indicate that lower-order cognitive processes carry significant weight at the 6th-grade level, whereas higher-order processes remain limited. This situation reveals that higher-order cognitive outcomes are not systematically supported, despite increased grade level, and supports the view that cognitive structuring needs to be enhanced in the curriculum.

6.6. Discussion and Conclusion Regarding the Sixth Sub-Problem

When examining the learning outcomes of 7th graders, the highest proportion was in the multistructural category (46.3%), followed by the relational (29.1%), unistructural (15.5%), and extended abstract (9.1%). Compared with the 6th grade, the learning outcomes at the multistructural stage significantly increased from 33.6% to 46.3%, while the outcomes at the relational stage decreased from 37.3% to 29.1%. The outcomes at the unistructural stage rose from 13.6% to 15.5%, whereas those at the extended abstract stage declined from 15.5% to 9.1%. This distribution indicates a decrease in the levels representing higher-order cognitive processes, whereas the levels covering more basic cognitive processes increased. This suggests that although an increase in higher-order cognitive outcomes would be expected as grade level advances, this expectation was not met in 7th grade, pointing to inconsistencies in the curriculum with respect to cognitive development. In a similar study, Gündöğdu and Aydın (2024) examined the 5th–8th grade learning outcomes of the 2018 science curriculum according to the revised Bloom's taxonomy. The analysis revealed that 69.7% and 30.3% of the learning outcomes were associated with lower-order and higher-order thinking skills, respectively. These parallel results, obtained from different evaluation frameworks such as the SOLO taxonomy and the revised Bloom's taxonomy, indicate that the cognitive demand level in 7th grade is predominantly at the basic and intermediate levels. This situation reveals that students' opportunities to develop higher-order thinking processes are limited and that the curriculum has not achieved the expected increase in the hierarchy of cognitive progression.

6.7. Discussion and Conclusion Regarding the Seventh Sub-Problem

When examining the learning outcomes of 8th graders, it was determined that the highest proportion was in the multistructural and relational stages (38.8% each), followed by the extended abstract (14.9%), and the lowest was in the unistructural stage (7.5%). Compared with the 7th grade, the learning outcomes at the multistructural stage decreased from 46.3% to 38.8%, whereas those at the relational stage increased significantly from 29.1% to 38.8%. The outcomes at the extended abstract stage rose from 9.1% to 14.9%, whereas those at the unistructural stage declined from 15.5% to 7.5%. This distribution indicates a tendency for the stages representing higher-order cognitive processes, such as relational and extended abstract, to increase, whereas the stages covering more basic cognitive processes, such as unistructural and multistructural, generally decrease. However, while higher-order cognitive processes would be expected to be more strongly emphasized at the 8th-grade level, the fact that the multistructural and relational outcomes remain at the highest rates suggests that the curriculum does not fully align with the expected systematic progression in cognitive development. This raises concerns that the multistructural level is insufficiently supported as a

transition to higher-order processes and may indicate the need to revise the curriculum regarding cognitive structuring. In support of this view, Acet et al. (2021) examined 8th-grade learning outcomes for the 2018 science curriculum and the LGS questions from 2019 and 2020 using the SOLO taxonomy. Their analysis revealed that the highest proportion of learning outcomes was at the extended abstract stage (34.54%), followed by the relational (32.72%), multistructural (21.81%), and unistructural (10.90%) stages. This difference suggests that in the 2024 science curriculum, the transition to higher-order cognitive levels for the 8th grade has been made more gradual and broad-based; however, this may have relatively reduced the proportion of outcomes at the extended abstract stage, limiting the expected cognitive deepening. Therefore, it can be argued that there is a need for arrangements that more systematically support the transformation of multistructural outcomes into higher-order cognitive processes to achieve the intended cognitive progression in the 2024 science curriculum.

In light of these results, the distribution of science curriculum learning outcomes across the SOLO taxonomy stages shows significant inconsistencies, particularly in achieving the desired balance between lower- and higher-order cognitive processes. This indicates that the planned gradual progression in students' cognitive development is not fully realized and supports the view that the curriculum's cognitive structuring may need reassessment.

In this study, the learning outcomes in the science curriculum within the framework of the Türkiye Century Education Model were analyzed using the SOLO taxonomy levels, yielding the results described above. Based on the findings, a set of recommendations has been proposed for teachers, curriculum developers, and policymakers to enhance the science curriculum, making it more coherent, balanced, and practically applicable.

It is recommended that teachers follow a scaffolded cognitive progression in each grade, building upon the previous level, and integrate learning outcomes at the relational and extended abstract levels—representing higher-order cognitive processes—into their lesson plans. In this context, providing sample activities, scenarios, and performance tasks that target higher-order outcomes may concretely support the development of advanced thinking skills in students.

For curriculum developers, defining a minimum number of learning outcomes that incorporate higher-order cognitive skills for each unit, reorganizing the outcomes by grade level, and including sample activities for their implementation in program documents are recommended. Additionally, establishing interdisciplinary teams composed of experts in cognitive development, assessment, and subject-matter education, and incorporating iterative processes such as pilot implementation, feedback, and curriculum revision can enhance its coherence and practical applicability.

From the perspective of policymakers, it is recommended to organize in-service training programs to enable educators to learn about cognitive classification systems, such as the SOLO Taxonomy, and to incorporate modules into teacher education programs that include writing and assessing learning outcomes aligned with cognitive taxonomies. These approaches can contribute not only to content proficiency but also to the systematic implementation of multidimensional strategies that consider students' thinking levels in curriculum development.

7. Declarations

7.1. Conflict of interest

The authors declare that they have no known competing financial interests, institutional affiliations, or personal relationships that could have appeared to influence the work reported in this paper.

7.2. Funding

This research received no external funding.

7.3. Author contributions (CRediT)

Caner Çabuk: Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization.

Cengiz Özyürek: Conceptualization; Methodology; Validation; Supervision; Project administration; Writing—review & editing.

7.4. Data availability statement

Data are available from the corresponding author upon reasonable request.

7.5. Ethics approval

This study was conducted in accordance with ethical principles. As it is a document review study, ethics committee approval was not required.

7.6. Use of artificial intelligence (AI) tools

The authors disclose the use of AI-assisted tools in the preparation of this manuscript for language editing support. AI tools were not used to generate or alter empirical data, produce analytical results, or shape the study's core findings and conclusions. All AI outputs were reviewed and verified by the authors, who take full responsibility for the integrity, originality, and accuracy of the content.

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Clarifying research problems and questions in education: A systematic review of definitions, quality criteria, formulation strategies and frameworks

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ABSTRACT

In educational research, there is often confusion about the distinction between a research problem and a research question. This uncertainty hampers conceptual clarity, alignment, and the overall methodological coherence of a research project. The Objective of the Review: Is to investigate and synthesise definitions, quality criteria, formulation strategies, and frameworks related to research problems and questions. A systematic review of the literature was conducted spanning 2000–2026. The review focused on English-language studies, and data were obtained from Google Scholar, ERIC, EBSCOhost, and the Directory of Open Access Journals. Texts were reviewed after being screened independently by both reviewers against predefined criteria. Using Cohen's κ, inter-rater reliability was assessed, and disagreements were resolved by consensus. The study was appraised using CASP checklists. The data were synthesised and analysed thematically and tested for stability through a sensitivity analysis. From the selected studies, 55 met the inclusion criteria. The following themes emerged from the data: the distinct significance and purpose of problems versus questions; the multiple origins of problems and how they are transformed into researchable questions; the criteria for strong formulation of research problems and questions; and frameworks for developing research problems and questions. The review suggested practical templates and checklists for writing research problems and questions. The evidence in the review included diverse sources, methods, contexts, and data types, as education literature remains limited. Also, formal frameworks for problem statements are limited; therefore, literature is, in some cases, adapted from other fields. Research problems and research questions are conceptually distinct yet interdependent. Applying explicit criteria, alignment checks, and appropriate frameworks can strengthen design decisions, analytic focus, and reporting quality in education research. The research used a correlational survey design.

KEYWORDS: Research methodology; Research problem; Research question; Frameworks; Alignment; Education research

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1. Introduction

Academic research is commonly understood as a systematic investigation aimed at describing, discussing, and explaining an observed phenomenon of interest (Muzari et al., 2022; Parathasarathy

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et al., 2023). Central to this process is the careful formulation of a suitable research problem. In this regard, Adu and Okeke (2022) noted that the first and most vital step in educational scientific research is the identification of a specific area of interest and a corresponding problem. Building on this idea, researchers argue that research problems (PBs) should be complemented with well-constructed research questions (RQs). Together, they serve as the starting point of rigorous scientific research (Han-Jing, 2023; Parathasarathy et al., 2023). Abdallah (2024, p. 1) emphasised that "In any educational research, the process of identifying a research problem and formulating clear research questions and objectives is crucial to setting the basis for a rigorous and meaningful inquiry". Several scholars (Bhagyamma & Ramesh, 2023; Kross & Giust, 2019; Parathasarathy et al., 2023) contend that both RPs and RQs facilitate effective planning and resource allocation and enhance research quality by guiding researchers in their pursuit of knowledge.

It is essential to note, however, that not all studies require research questions. For instance, certain types of studies, such as conceptual and theoretical investigations, often rely on a research problem and an overarching aim rather than specific questions (Grant & Osanloo, 2014; Ravitch & Riggan, 2016; Taherdoost, 2022). Conversely, empirical studies typically rely on research questions to structure data collection and analysis, thereby ensuring rigour and clarity (Bahishti, 2022; Aguinis, 2025). That said, Gill and Gill (2020) cautioned that empirical studies risk losing focus and producing unreliable or non-generalizable findings if they lack well-defined questions. Against this backdrop, it becomes clear that, despite researchers' agreement on the importance of research RPs and RQs, their distinct purposes are often misunderstood.

Han-Jing (2023) opined that part of the confusion surrounding RPs and RQs stems from their close relationship, which can leave novice researchers struggling due to limited understanding (Ellis & Levy, 2008; Pardede, 2018; Adu & Okeke, 2022). This challenge is likely compounded by divergent viewpoints among researchers. For example, Madhu et al (2024, p. 1) defined a research problem as "a specific question, issue, or area of inquiry that a researcher wants to investigate or explore through the process of research", while Akhidime (2017, p. 633) in contrast, remarked that a "research problem could present itself as a condition to be improved upon, a difficulty or deficiency to be overcome, or a gap in knowledge that exists in scholarly literature that is to be filled, or theory that requires meaningful understanding". These contradictory perspectives illustrate the conceptual vagueness in the literature, leading postgraduate students, for instance, to struggle to articulate clear RPs and RQs (Akram et al., 2023; Ellis & Levy, 2008). It's not strange, therefore, that scholars such as Rustipa et al. (2023) blamed the lack of scholarship as a contributing factor. On this point, Singh (2023) contended that research primarily focuses on identifying concepts and the characteristics of research problems and research questions, rather than on their conceptual differences. This lack of clarity has serious implications, including poorly aligned studies, shallow methodological reasoning, and misinterpretation of research aims.

This manuscript seeks to address this gap by clarifying the conceptual differences between the problem statement and the research question. By examining their respective functions, structures, and roles within the research process, we aimed to present practical frameworks to guide researchers in conducting methodologically sound studies. To achieve this aim, the review seeks to answer the following questions:

Primary Research Question

How are research problems and research questions defined, distinguished, and effectively formulated within the field of education, and what quality criteria, strategies, and frameworks does the literature identify to guide their development?

Sub-questions

Research Question 1 (RQ 1): What is the significance and purpose of clearly defining research problems and research questions within the research process?

Research Question 2 (RQ 2): How do research problems and research questions typically originate, and what sources or conditions give rise to them?

Research Question 3 (RQ 3): Which criteria should be applied to formulate effective, rigorous, and actionable research problems and research questions?

Research Question 4 (RQ 4): How can conceptual or theoretical frameworks and checklists be used to guide the development and refinement of research problems and research questions?

1.1. Conceptual Framework

To address these questions, the systematic review adopted a structured approach, grounded in a conceptual framework. This ensured an appropriate lens through which the data were interpreted and analysed (Ravitch & Riggan, 2017). Drawing on Antonenko's (2015) work, the Conceptual Framework was aligned with the topic's significance. This included justifying the problem (under the introduction), defining relevant concepts, establishing a theoretical rationale for the research, selecting appropriate methods, and interpreting the results in relation to the theory (Antonenko, 2015). Extending from these considerations, this study is based on two primary concepts: research problems and research questions. Lund (2022) described RPs as an important means, pointers or guides to attaining valuable knowledge, while Goldschmidt and Matthews (2022, p. 2) stated: "... questions are the basis on which inquiry takes place in all domains". For conceptual clarity, the characteristics of both problem statements and research questions are described, and a comparative analysis is conducted throughout the study. The emphasis on defining research questions and problem statements (Kross & Giust, 2019) highlighted the theoretical importance of clear, methodologically grounded questions in guiding research design.

Figure 1 ***The Conceptual Framework***

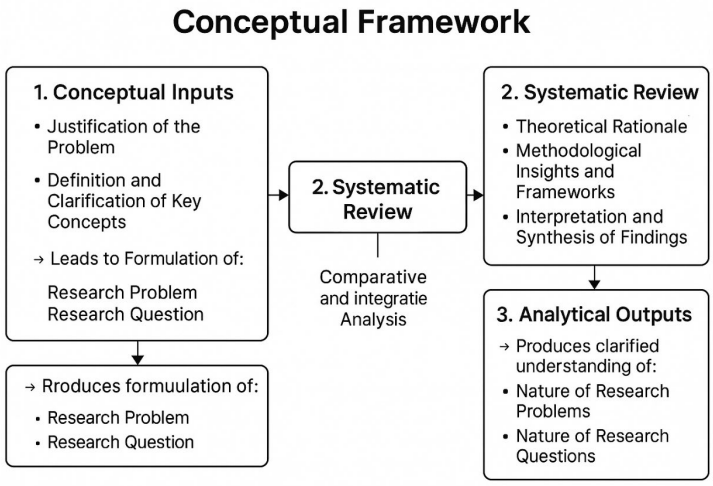


Figure source: Antonenko, 2015

1.2. Literature Review

Aligned with the conceptual framework, this study is anchored in theoretical dimensions that collectively underpin the formulation and role of research problems and research questions. First, a discussion of the research problem's dimensions.

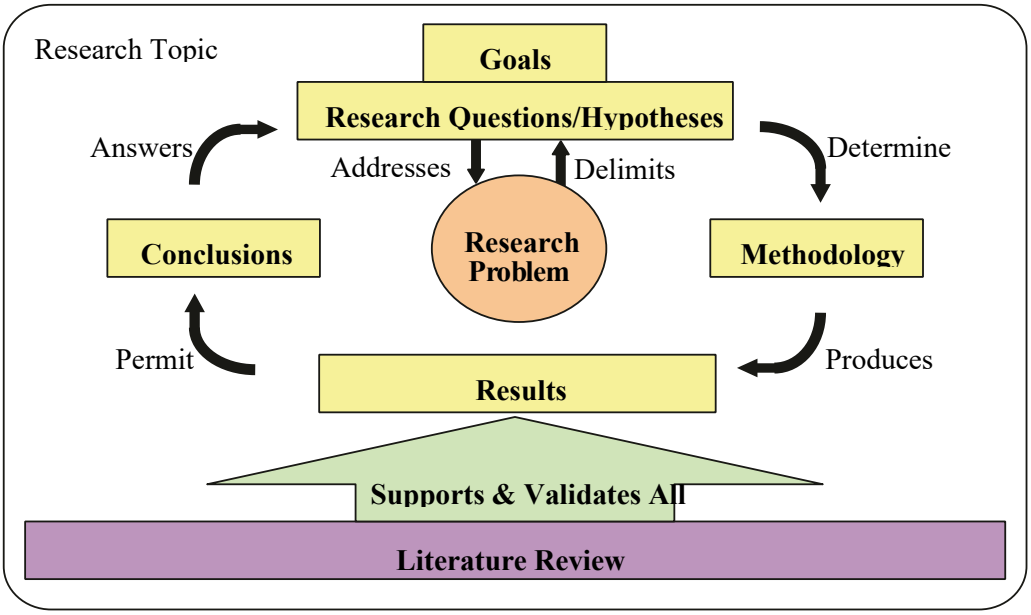
1.2.1. The Foundational Role of a Research Problem

"I keep six honest serving-men (They taught me all I knew); Their names are What and Why and When And How and Where and Who" (Kipling, 1902/1988, p. 3, in Ellis & Levy, 2008). This verse stresses the critical role of the research problem statement in guiding scholarly research by clarifying what is studied, why it is important, when and where it occurred, how it developed, and who is involved (Kehinde, 2025). In line with these views, scholars consistently rank the RP as the point of departure for scholarly inquiry. Charles et al. (2016) and Han-Jing (2023), for example, averred that the initial step in the research process is to identify and define the RP. Moreover, it is viewed as the main element that anchors successful decisions in a study, including the study's focus and rationale (Han-Jing, 2023; Pardede, 2018), much as a building's foundation supports structural stability (Rahman et al., 2022). Booth et al. (2016) added that the problem can be either practical or conceptual. In practice, the problem statement should identify a knowledge gap that is insufficiently addressed or remains inconclusive, necessitating further investigation (Creswell & Creswell, 2018; Stevens, 2024). Together, these assertions highlight how the RP shapes the direction and relevance of the research process.

1.2.2. From Problem Definition to Research Design

Since research problems underpin scholarly research, a clearly articulated problem should delineate the specific issue from its broader context to ensure focus and prevent deviation from the central theme (Bhagyamma & Ramesh, 2023; Haddaq et al., 2024). Correspondingly, Pardede (2018) argued that the RP also serves as a coherent framework (Figure 2) for the entire research project, guiding the selection of appropriate literature and research methodology, and aligning with the research objectives and questions (Younas et al., 2023). On this point, Haddaq et al. (2024) also suggested that a thorough understanding of the RP facilitates easier interpretation and analysis, yielding more accurate results. Conversely, vague and ambiguous RPs impede effective study management, leading to confusion and a loss of focus (Han-Jing, 2023; Pardede, 2018). In short, well-executed research establishes clear parameters for a thorough investigation.

Figure 2 ***Research problem serving as a coherent framework (Ellis & Levy, 2008, p. 20)***



1.2.3. Strategies for Identifying and Narrowing Research Problems

Research shows that research problems can originate from various sources. For instance, the sections on "future research" suggestions indicate numerous opportunities for further investigation (Ravindra, 2022; Terrell, 2022). Replicating existing studies in new contexts can also yield different findings. For example, a study on the leadership skills of secondary school principals may yield different insights when replicated with primary school principals (Terrell, 2022). Therefore, staying up to date with the latest literature enables researchers to identify gaps or areas of insufficient knowledge (Haddaq et al., 2024; Ravindra, 2022). As Abdallah (2024, p. 1) explained: "The ability to pinpoint a relevant, researchable problem reflects a deep understanding of the field, as well as an awareness of the current gaps in knowledge that require exploration". Also, exchanges with colleagues, experience from own practice, and media reports can generate viable research ideas (Wolhuter in Okeke & Van Wyk, 2015).

1.2.4. Components and Quality Criteria for Effective Problem Statements

Younas et al. (2024) identified three key components that structure an effective RP: context, significance, and purpose. Context situates the phenomenon within a larger subject area, providing the information needed to define and address the problem efficiently (Reffner & Kammrath, 2023). Furthermore, as Stevens (2024) noted, context provides essential information, ensuring that scientific investigations are well directed towards the effective addressing of complex issues. Concerning significance, social scientists established that the problem should be interesting to both the researcher and the reader (Bhagyamma & Ramesh, 2023; Ravindra, 2022). In this regard, Terrell (2022) explained that a lack of interest often leads to failure or incomplete work due to diminished energy and enthusiasm. This point is supported by Bhagyamma and Ramesh (2023), who mentioned that genuine interest improves motivation, creativity, and engagement. Regarding the purpose of the RPs, Terrell (2022) emphasised the importance of adhering to ethical considerations. Likewise, scholarly enquiries should be feasible and practical (Bhagyamma & Ramesh, 2023), address a manageable knowledge gap within the given time frames, possess both theoretical and practical significance, and include sufficient RPs (Ravindra, 2022). Together, these studies confirm that understanding these key components will ensure clearly delineated and articulated research problems. Yet, as Haddaq et al. (2024) pointed out, establishing clear criteria for RPs is essential but challenging. They should display sharp focus, avoid excessive multiple titles, and be researchable and measurable (Ravindra, 2022; Younas et al., 2023). Additionally, researchers need to adhere to the principles of scientific formulation and reasoning (Terrell, 2022).

1.2.5. Defining and Understanding the Research Question

The RQ is widely regarded as the other anchor of a study. Shaheen et al. (2023, p. 2) reminded us that "a research question is the first cornerstone for building an interesting research project." Barrios et al. (2024) believed that the RQ is what the researcher and the study aim to answer. Similarly, Kross and Giust (2019, p. 24) are among those who described it as "... an unambiguous statement that clearly articulates the phenomenon you plan to investigate." In line with this need for precision, the RQ should be aligned with and correspond to the study's problem (Han-Jing, 2023). Nonetheless, some RPs are complex and may necessitate multiple research questions (Kross & Giust, 2019).

1.2.6. Deriving Research Questions from Research Problems

The RQ(s) stem from the research problem (Han-Jing, 2023). Accordingly, Jansen (2019) commented that the research problem is typically stated before the research question. In fact, Parathasarathy et al. (2023) emphasised that the success of research depends largely on the researcher's ability to transform the RP into an RQ. To illustrate this process, a problem such as "postgraduate students

struggle to write a clear problem statement" may lead to a question such as "How do postgraduate students experience problem statement writing during the academic writing process?" On top of that, as research projects are often complex, multiple research questions are formulated, referred to as sub- or secondary questions (Mahesh, 2024). Amidst the quest for conciseness, Fandino (2019) cautioned that careful consideration is vital when preparing multiple RQs, as too many questions may require different research designs and disperse the study's focus. In conclusion, Barroga and Matanguihan (2022, p. 1) observed: "Excellent research questions are focused and require a comprehensive literature search and in-depth understanding of the problem being investigated".

1.2.7. The Centrality of Research Questions in Achieving Research Success

As underscored by Jansen (in Maree, 2019) and later Parathasarathy et al. (2023), the success of any research project hinges fundamentally on the quality of the RQ. As Cohen et al. (2018, p. 167) declared: "Research questions should enable the researcher to make a significant and innovative contribution to the field of study, say something new and interesting, and contribute to the concerns and current topics in the academic community". While the RP sets the general direction, the RQ provides a focused, specific line of inquiry (Hosseini et al., 2024; Kross & Giust, 2019). Jansen (in Maree, 2019) also asserted that an RQ plays a critical role in confirming and clarifying what genuinely intrigues the researcher and in providing a focus for the study. In addition, Hosseini et al. (2024) argued that a well-posed research question facilitates the identification of pertinent factors, relevant literature, and appropriate research methodologies. This includes the study design. As Maxwell (2013, p. 73) confirmed: "Your research questions—what you specifically want to understand by doing your study—are at the heart of your research design". Structuring them necessitates careful planning, which is crucial to prevent unethical research approaches, weak outcomes, engagement with irrelevant literature, uncertain research approaches, and the reliance on false or low-quality evidence (Barroga & Matanguihan, 2022; Covvey et al., 2024; Ganesha & Aithal, 2022; Hosseini et al., 2024).

1.2.8. Frameworks and Considerations for Developing Research Questions

Frameworks provide researchers with guidance for crafting appropriate RQs across quantitative, qualitative, and mixed-methods studies. As the formulation of sound RQs demands thoughtful consideration (Hosseini et al., 2024; Jansen, 2019), Covvey et al. (2024) proposed a structured approach to address all its complexities. Frameworks can provide structure and support researchers in formulating clear, focused, researchable, and scientifically justified questions. Considering this idea, Kabir et al. (2023, p. 3500) reported that "it is a common practice to use an established framework to assist in this process". Also, van der Waldt (2025) supported the idea that using frameworks helps address complex problems and ensures specific, focused research. Thus, using "some tools," such as frameworks, can greatly help achieve this objective (Shaheen et al., 2023, p. 2).

1.2.9. Quantitative and Interventional Frameworks

The widely used PICO(T) framework provides valuable guidelines to structure RQs in quantitative and interventional studies (Covvey et al., 2024; Fandino, 2019; Hosseini et al., 2024; Parathasarathy et al., 2023). It comprises five elements that work collectively to guide question formulation:

- Patient/Population/Problem (P): Specifies the subject of the study and inclusion and exclusion criteria.
- Intervention (I): Specifies the action (related to the outline of the methodology).
- Comparison (C): Outlines the alternative intervention.

- Outcome (O): Outlines the desired results.
- Time (T): Refers to the duration of the investigation (Covvey et al., 2024; Fandino, 2019; Hosseini et al., 2024).

The PECODR (Population, Exposure, Comparison, Outcome, Design, and Result) framework is considered an extension of the PICO model (Dawes et al., 2007). Apart from assisting researchers in formulating appropriate RQs, it is often used in systematic reviews and evidence-based practice (Covvey et al., 2024).

1.2.10. Qualitative and Mixed Methods Framework

Hosseini et al. (2024) noted that the type of study determines the choice of framework. In this regard, Covvey et al. (2024) noted the usefulness of the SPIDER framework (Sample, Phenomenon of Interest, Design, Evaluation, Research type) for qualitative and mixed-methods research. Moreover, this framework encourages scholars to address the "who", "what", and "how" questions in their research projects (Covvey et al., 2024). Additional frameworks used in qualitative research in educational contexts include:

PCC, PEO, and PFO. The PCC framework (P: Population, C: Concept, C: Context) refers to the study participants, the main concept being studied, and the context in which the phenomenon occurs. This framework is particularly applicable to scoping reviews and exploratory studies (Hosseini et al., 2024).

The PEO framework (Population to be studied, E-Exposure/Environment that influences the population, and the outcome (O), which points to the outcome of the study) is useful for exploring relationships between experiences and outcomes in non-interventional contexts (Kabit et al., 2023). Munn et al. (2018:3) indicated that this framework can be used to "determine the association between a particular risk and outcomes".

The last framework is the PFO framework, which stands for P-Population, F-Factors (the key variables, influences, or phenomena of interest), and O-Outcomes. This framework is mostly used in observational or exploratory studies. Besides, Munn et al. (2018:3) acknowledged that the purpose of a PFO framework is to "determine the overall prognosis, the link between specific prognostic factors and an outcome". According to Hirose and Creswell (2023), quantitative and mixed-methods studies include questions and hypotheses, whereas qualitative studies state questions or aims rather than hypotheses.

1.2.11. Frameworks for Service Evaluation, Policy, and Applied Settings

In applied, policy, or service evaluation contexts, frameworks such as ECLIPSE and SPICE provide a structure for questions related to service design, delivery, and impact.

ECLIPSE (Expectation, which helps researchers articulate the intended outcomes), C (Client group, focusing on the target population), L (Location, the geographic area where the service is provided), I (Impact, the effect of the actions), P (Professionals, those who are involved), and S (Service: evaluation of services). This framework is mostly suitable for assessments and for researchers focusing on projects, services, or policies (Covvey et al., 2024, p. 67). Hosseini (2024:2) advocated for its use, stating that it is used for "policy and management".

The SPICE framework comprises the Setting, Perspective, Intervention, Comparison, and Evaluation. This framework is useful for evaluations within specific organisational, social, or educational settings (Covvey et al., 2024).

1.2.12. Evaluation of Research Questions Using the FINER Framework

To ensure that RQs are concise, though robust and meaningful, they should be evaluated. For this reason, researchers apply evaluative frameworks to test the quality of a question against established criteria. The FINER framework, with its dimensions of feasible, interesting, novel, ethical, and relevant, is the appropriate framework for assessing RQs and refining them to enhance clarity and practicality (Covvey et al., 2024; Fandino, 2019; Goldschmidt & Matthews, 2022; Han-Jing, 2023). According to Han-Jing (2023) and Covvey et al. (2024), the term "feasible" implies that the RQ is practical within the researchers' capabilities and resources, whereas the term "interesting" suggests that the question should be captivating. Goldschmidt and Matthews (2022) averred that the term "novel" guarantees that the question addresses an unexplored issue. What's more, the concept "Ethical" ensures the research will not cause harm or ethical conflicts, while the word "relevant" implies that the question is significant to the scientific community and society (Covvey et al., 2024; Han-Jing, 2023). To maintain relevance, frameworks should be reviewed and revised iteratively throughout the research process (Mahesh, 2024).

Checklists and templates can also be used to ensure that research problems and questions meet the required standards.

1.2.13. Research Problem Development Checklist

Gap identified: Does the problem clearly identify a conceptual, empirical, or practical gap in educational research? (Barroga & Matanguihan, 2022; Busetto et al., 2020; Creswell & Creswell, 2017; Han-Jing, 2023; Nassaji, 2023; Purvis et al., 2024; Srinivas et al., 2023).

Context and multidisciplinary considerations specified: Is the educational setting clearly described (e.g., schooling level, discipline, geographical or institutional context)? (Nishiyama & Leleito, 2018).

Significance and relevance justified: Does the problem answer the "So what?" question for theory, practice, or policy? Does it address gaps in existing literature or practical issues (Supino & Epstein, 2012)?

Population and context identified: Are the learners, educators, institutions, or stakeholders affected by the problem explicitly indicated? (Reffner & Kammrat, 2023).

Scope manageable: Is the problem narrow and feasible enough to be investigated within time, ethical, and resource constraints? (Aityan, 2022; Terrell, 2022).

Integration with purpose, literature, methods, and results: Does the problem logically motivate the study's aim or purpose statement? (Ochoa-Pachas, 2024; Younas et al., 2024).

Kehinde (2025) proposed a structured, yet flexible three-stage method for developing problem statements, dividing each statement into the ideal situation, the problem with challenges, and the problem's consequences.

1.2.14. Formulation Template for Problem Statements

Despite growing emphasis on [educational practice/policy/approach], there is limited empirical evidence regarding [specific issue or gap] among [population] in [educational context]. Existing studies have largely focused on [what is known], leaving insufficient understanding of [what is unknown or contested]. This gap limits [educational outcomes, decision-making, or theory development], underscoring the need for a systematic investigation.

1.2.15. Research Question Quality Checklist

- Is the research question directly derived from the problem? (Han-Jing, 2023).
- Is the research question interrogative and precise? (Hosseini et al., 2024).

- Can the question be answered using identifiable qualitative, quantitative, or mixed methods? (Hosseini et al., 2024).
- Does the question acknowledge educational context (setting, participants, system)? (Covvey et al., 2024).
- Does the question clearly guide sampling, data collection, and analysis? (Covvey et al., 2024).
- Is the question Feasible, Interesting, Novel, Ethical, and Relevant? (Covvey et al., 2024; Fandino, 2019; Goldschmidt & Matthews, 2022; Han-Jing, 2023).
- If multiple questions are used, do they complement rather than duplicate one another? (Fandino, 2019; Jansen, 2019).

1.2.16. Template for Research Question Set (Derived from the Problem)

Central Research Question

- How does [key phenomenon] influence [outcome/experience/process] among [population] in [educational context]?

Sub-questions (if applicable)

- What are the perceptions or experiences of [participants] regarding [phenomenon]?
- What contextual factors shape [phenomenon] in [setting]?
- What outcomes or implications emerge from [phenomenon] for [practice/policy/theory]?

2. Method

This study employed a qualitative research approach within a systematic review framework, aligning with the views of Aten and Denney (2023), who argued that the main aim of qualitative research is to gain a deep understanding of a particular phenomenon.

Table 1 ***Eligibility criteria***

Focus areas	Inclusion criteria	Exclusion criteria
Study type	Peer-reviewed articles, conference papers, theses and dissertations.	Editorials, opinion pieces, book reviews, and non-peer-reviewed articles.
Language	Studies published in English.	Studies published in languages other than English.
Publication date	Studies published from 2000 onwards.	Studies published before 2000.
Focus	Studies explicitly discuss the differences between problem statements and research questions.	Studies that do not specifically address the distinctions between problem statements and research questions.
Methodology	Qualitative, quantitative and mixed-methods.	Studies with unclear or poorly defined methodologies.
Discipline	Studies from various disciplines, including social sciences, education and health sciences.	Unrelated fields or topics.
Accessibility	Full-text articles available.	Requesting payment to access articles.

The SLR applied a language restriction to English only because most scholarship on the topic is conducted in English. By establishing clear criteria, we aimed to improve the study's reproducibility. This process was also essential for verifying results, building on previous research, and managing the study. The reference list provided evidence of all the databases, registers, websites, organisations, reference lists, and other sources consulted to identify studies. To minimise bias, we employed a rigorous and transparent approach during the search (Gusenbauer & Haddaway, 2020). For this purpose, we used the Risk of Bias in Systematic Reviews (ROBIS) instrument to evaluate the overall trustworthiness of the reviews' conclusions (Shaheen et al., 2023). Our focus was on multiple major bibliographic databases to conduct a comprehensive search encompassing diverse perspectives and disciplines relevant to the study (Gusenbauer, 2022).

- ERIC (Education Resources Information Centre)
- EBSCOhost (EBSCOhost Research Platform)
- Directory of Open Access Journals (DOAJ)
- PubMed
- SciSpace

Search engines such as Google Scholar and Google were also used to widen coverage (Pillay, 2024; Tawfik et al., 2019). Filters were applied to keywords, titles, and abstracts to ensure that the topic was thoroughly examined. These filters included phrases such as "problem statements", "research questions", "differences between problem statements and research questions", "formulating research questions", and "developing problem statements". Starting with a pilot search strategy, the search was monitored and periodically updated to incorporate newly published studies. Boolean operators, such as AND, OR, and NOT, were used to refine the search, and we adapted the word order for different databases (Skinner, 2023).

2.1. Screening and Study Selection Process

The screening process involved multiple steps to ensure only relevant, high-quality studies were included. Initially, titles and abstracts were assessed by two independent reviewers for relevance using predefined criteria. Studies that did not meet the qualification criteria were excluded. Next, a detailed full-text review was conducted to determine final inclusion. The reviewers conducted their work independently but met weekly to discuss the process and resolve uncertainties. Reasons for exclusions were documented to support transparency and reproducibility, and then data extraction followed. A Standardised form was used during this process (Table 2). To evaluate consistency among reviewers during the screening process of the title, abstract, and full-text screening, Cohen's Kappa (k) model of Inter-Rater Reliability (IRR) was employed. This established how the reviewers evaluated, scored, and classified the research topic. Cohen's method provides a strong statistical measure of inter-rater agreement (Li et al., 2023). Kappa values were interpreted using standard benchmarks (e.g., $\kappa < 0.40$ = fair agreement; 0.41–0.60 = moderate; 0.61–0.80 = substantial; >0.80 = almost perfect). The use of Cohen's Kappa strengthened the credibility, reproducibility, and reliability of the selection process by identifying areas requiring adjustment (Almehrizi, 2025).

2.2. Role of the Researchers

The researchers designed a clear review protocol, a process supported by Gough and Newman (in Zawacki-Richter et al., 2020). This process included defining the purpose, eligibility criteria, search strategy, and appraisal methods. A comprehensive literature search was conducted across multiple databases using structured keywords. This was followed by an independent screening of studies.

Inter-rater reliability was verified using Cohen's Kappa. Data were extracted using a standardised form (Table 2), and the quality of the study was appraised using the CASP checklists with dual-reviewer consensus (CASP, 2023). The researchers synthesised findings through thematic analysis. Objectivity was maintained through language-neutrality checks and sensitivity analyses.

Table 2 ***Summary of Data Extraction Plan***

Step	Description	Actions
Identify data sources	Determine relevant literature sources.	Search databases, journals and repositories
Pilot testing	Tested extraction form	Conducted a trial run on a subset of studies
Extract data	Extract from selected studies.	Use the standardised form
Data cleaning	Reviewed and cleaned for completeness	Checked for inconsistencies, missing data, and errors.
Data synthesis	Analyse the extracted data.	Used qualitative methods to synthesise the data and draw conclusions.
Monitoring	Maintain quality	Ensured ongoing accuracy and consistency in data extraction.

2.3. Characteristics of the Study

To ensure trustworthy reporting, we adhered to the highest quality standards (Page et al., 2021). Documenting the search process is essential, as it enhances replicability and provides a basis for future updates (Gusenbauer & Haddaway, 2020). In terms of quality, we followed the advice offered by Gough and Newman (in Zawacki-Richter et al., 2020): the study design should be suitable for the RQ, the study methods should be executed with rigour, and the relevance of the review questions to the study should be assessed. To ensure methodological strength, a Critical Appraisal Skills Programme (CASP) was used (Carroll & Booth, 2014). Using a CASP checklist (Appendix B), the two reviewers structured their prompts to evaluate the validity, results, and relevance of the included studies. The two reviewers completed the checklist independently, discussed the discrepancies, and reached consensus. To promote comprehensive and transparent reporting and minimise discrepancies between protocols and completed reviews, we adhered to the PRISMA-P checklist (Shaheen et al., 2023; Shamseer et al., 2015). This rigorous approach strengthened the trustworthiness and applicability of the findings (Page et al., 2021). Additionally, we conducted an extensive literature search to enhance the reproducibility, reliability, and overall quality of the review (Iqbal et al., 2022). An emphasis on study quality, objectivity, and bias was operationalised using measurable criteria. For this reason, specifically, we employed a language-neutrality checklist (Appendix C) to avoid leading or value-laden phrasing in data extraction and synthesis. This checklist is supported in:

- Avoiding adjectives that imply judgment (e.g., "significant," "important") unless statistically supported.
- Using consistent terminology across studies.
- Ensuring interpretations are grounded in evidence rather than the researcher's assumptions.

To further ensure transparency and accountability, we registered the review protocol on OSF (https://doi.org/10.17605/OSF.IO/M9K2T), in which we clarified the intent, methods, and inclusion criteria prior to data collection. This process reduced bias (Frewen et al., 2023).

2.4. Sensitivity Analysis

A sensitivity analysis was conducted to assess the quality of the review's findings (Marušić et al., 2020). The synthesis was rerun after excluding studies rated as low quality. The idea was to determine whether such studies overly influenced the overall conditions of this study. Themes were then derived from the full dataset and compared with those from subsets. Lastly, the reviewers re-evaluate the agreements after removing borderline cases that did not meet the study's criteria (Carroll & Booth, 2014). The sensitivity analysis supported the trustworthiness and transferability of the results.

2.5. Data Synthesis Process

We conducted a reflexive thematic analysis comprising familiarisation with the data, inductive coding, theme development, review, and definition and reporting (Braun & Clarke, 2021). A detailed codebook containing all codes, definitions, and inclusion/exclusion boundaries is provided in Appendix A. The reviewers double-coded an initial 20% of the sub-categories and reconciled discrepancies through discussion. Discrepancies were addressed with follow-up discussions. Decisions were documented in reflective journals, with audit trails that trace the process of translating the codes into themes. The execution stage comprised implementing the search strategy, screening titles and abstracts, and retrieving full-text articles. Extracted data were synthesised through thematic analysis and interpreted accordingly. In line with PRISMA requirements, results were compiled into a structured report with periodic updates. To reduce publication bias, grey literature sources—including conference proceedings, theses, and dissertations—were incorporated (Gusenbauer & Haddaway, 2020). The search, conducted between March 2024 and February 2026, targeted studies published from 2014 to 2026 to ensure relevance. Initially, 569 records were identified; after removing duplicates, 480 remained. Title and abstract screening excluded 188 records, leaving 292 for full-text review. Of these, 237 were excluded for the following reasons:

- 164 were irrelevant
- 45 lacked full text
- 11 were not in English
- 7 were not peer-reviewed
- 7 were duplicates
- 3 employed questionable methodologies.

Ultimately, 55 articles were included in the final analysis. Figure 3 illustrates the PRISMA flow diagram summarising the screening and selection process.

Figure 3 ***PRISMA flow diagram of studies screening and selection***

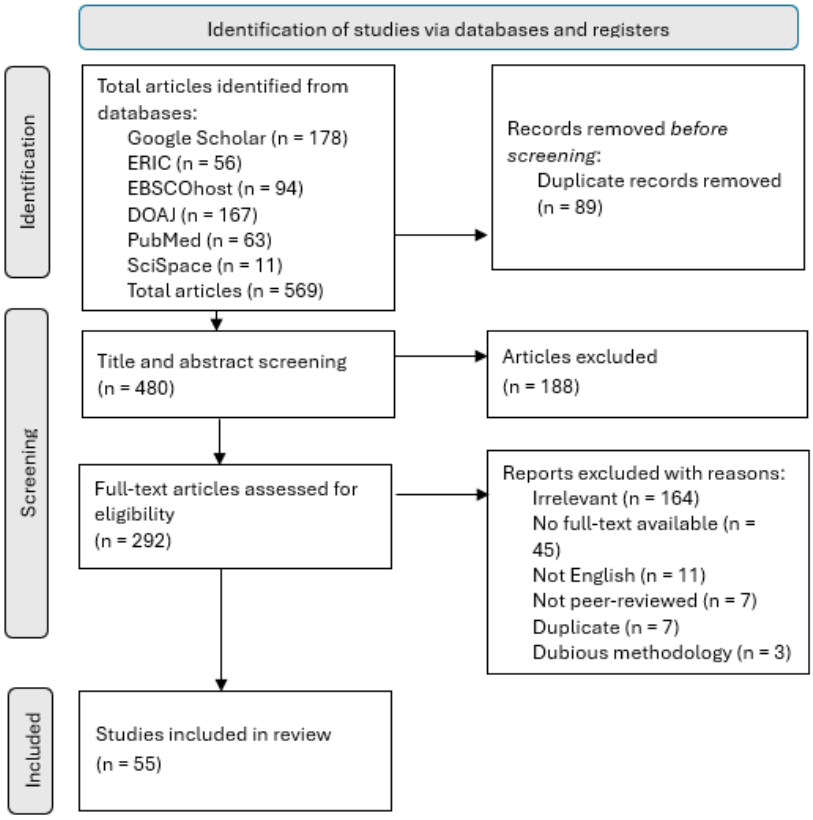


Figure source: Adapted from Page et al. (2021)

3. Results

The data were coded, and similar segments were categorised and clustered according to themes (Miles et al., 2024). This systematic coding procedure is used to ensure rigorous, transparent findings. Each included study was read repeatedly to ensure familiarity with its content before meaningful segments of text were identified and assigned initial descriptive codes. These codes captured core ideas related to the study's aims, including distinctions between research problems and research questions, their functions, origins, formulation criteria, and associated frameworks. This was an iterative and recursive process in which the codes were refined, merged, and expanded as new insights emerged. The following four themes were developed:

- The Significance and Purpose of Defining Research Problems and Questions
- Origins and Sources of Research Problems and Research Questions
- Criteria for Formulating Effective and Rigorous Research Problems and Questions
- The Role of Conceptual and Theoretical Frameworks in Developing Research Problems and Questions

3.1. The Significance and Purpose of Research Problems and Research Questions

Table 3 summarises the significance and purpose of RPs and RQs, differentiating among their primary functions, scope, roles in design and formulation, and typical formats. It also incorporates relevant studies to illustrate variations in how these constructs are conceptualised.

Table 3 *The Significance and Purpose of Research Problems and Research Questions*

Aspect	Research Problem	Research Question	Representative Sources
Primary function	Establishes significance and need by identifying a practical or conceptual gap; justifies the inquiry.	Operationalises the inquiry into specific, answerable prompts that guide methods and analysis.	(Barroga & Matanguihan, 2022; Busetto et al., 2020; Creswell & Creswell, 2017; Han-Jing, 2023; Nassaji, 2023; Purvis et al., 2024; Srinivas et al., 2023)
Scope	Broad, contextual, justificatory (the "so what?").	Narrow, focused, method-directing (the "what/how/why?").	(Barroga & Matanguihan, 2022).
Role in design	Frames aim/purpose and motivates relevance; identifies knowledge gaps.	Shapes sampling, instruments, procedures, and analytic strategy.	(Creswell, 2017; Han-Jing, 2023; Maxwell, 2013; Purvis et al., 2024)
Formulation	Often articulated early to justify contribution.	In flexible designs, refined iteratively as understanding deepens.	(Maxwell, 2013).
Typical format	Declarative statement describing an issue/gap.	Interrogative statements (central + subquestions) or hypotheses (quantitative).	(Creswell & Creswell, 2017).

This data highlighted meaningful differences between RPs and RQs, particularly in terms of their significance and purpose. Moreover, RPs are central to addressing pressing issues, whereas research questions guide the investigations required to address those gaps. The study also revealed that although both RPs and RQs establish the boundaries for the research enquiry, they do so in distinctive ways. While the problem sets a broad context and provides a justification for the research, the questions narrow the scope by setting focused boundaries. These boundaries guide the literature search, research approach, design, and data collection methods. This, in turn, directs the process of evidence finding and analysis. To address these mixed demands, educational researchers often employ multiple RQs, especially in larger studies or when addressing complex research problems.

3.2. The Origins and Sources of Research Problems and Questions

Table 4 below summarises typical sources of research problems and the routes through which they develop into RQs. It includes examples from relevant studies to show how researchers identify problems rooted in conceptual, social, or contextual origins, and then refine these into coherent questions that guide methodological decisions.

Table 4 *Route of Development for Research Problem into Research Questions*

Source of the problem	Examples	How a Research Problem Is Transformed into Research Questions	Representative sources
Conceptual/theoretical debates	Competing explanations; unresolved constructs	Pose questions that test/compare frameworks or specify relationships	(Booth et al., 2016; Creswell & Creswell, 2017; Han Jing, 2023; Pardede, 2018; Purvis et al., 2024; Srinivas et al., 2023).
Social/cultural contexts	Local practices; cultural constraints	Frame questions around context, meaning, and process	(Akhidime, 2017; Bryman et al., 2021; Madhu et al., 2024)

Source of the problem	Examples	How a Research Problem Is Transformed into Research Questions	Representative sources
Technological/policy change	New tools, reforms, and regulations	Ask evaluative or explanatory questions about impacts and adaptation	(Madhu et al., 2024).

The key result demonstrated that RPs rarely arise from a single source. They can arise from a network of intellectual discourse and practice. These include the "suggestions for further research" sections in completed studies and a need to replicate completed research. Replicating studies validate or challenge prior findings, refine theories, and enhance methodological precision. In a field such as education, where reproducibility is often a concern, replication is critical. Researchers need to keep abreast of the current literature by understanding current debates, contradictory findings, and emerging trends. Collaboration and scholarly exchange through conferences and interactions with other scholars also enable the sharing of research ideas and the critical feedback on them. In the field of education, RPs also arise from conceptual, contextual, and policy dynamics. Ambiguities in these fields create opportunities for further research, including comparative or clarifying investigations. Lastly, RPs also stem from evaluative and explanatory investigations, including implementation, impact, and institutional adaptation.

3.3. The Criteria for Formulating Effective Research Problems and Questions

Table 5 outlines the key criteria for scholarly standards that ensure clarity and coherence in research problems and questions. It also illustrates how each applies differently to RPs and RQs, drawing on guidance from the established methodological literature.

Table 5 ***Key criteria to ensure clarity and coherence in research problems and questions***

Criterion	Research Problem	Research Question	Key sources
Significance	Addresses a meaningful gap (practical or conceptual); passes the "So what?" test.	Targets a specific facet of the problem that can be answered empirically.	(Booth et al., 2016, 2018; He et al., 2023)
Clarity & focus	Clear statement of the issue and boundaries (phenomenon, population, context).	Interrogative, specific, bounded ("what/how/why") — serves as a design signpost.	(Creswell & Creswell, 2022; Maxwell, 2013)
Feasibility & ethics	Achievable with available time, data access, expertise; ethically approvable.	Answerable with feasible methods/measures and acceptable participant burden.	(Covvey et al., 2024; Fandino, 2019; Goldschmidt & Matthews, 2022; Han-Jing, 2023)
Relevance & novelty	Contributes to knowledge, policy, or practice. Advances debate.	Produces interpretable, decision-useful evidence (outcomes, experiences, mechanisms).	(Covvey et al., 2024; Fandino, 2019; Goldschmidt & Matthews, 2022; Han-Jing, 2023)
Context sensitivity	Locates the issue in the setting, stakeholders, and systems.	Incorporates setting/perspective/context where appropriate.	(Booth et al., 2018; Covvey et al., 2024; Fandino, 2019; Goldschmidt & Matthews, 2022; Han-Jing, 2023)

Criterion	Research Problem	Research Question	Key sources
Alignment	Coherent with aims/purpose; motivates the study.	Aligns aims → methods → analysis; prevents fragmentation.	(Heitner, 2014; Newman & Covrig, 2013)

The review made clear the foundational role of RPs, which hinge on several probing questions that collectively ensure depth, direction, and intellectual resolution in their formulation. In addition, RPs identify a significant gap in a field. Conversely, RQs target specific components of that problem to guide the inquiry. Both require correct formulation, feasibility within constraints, and clear theoretical or practical relevance. The review emphasises that researchers should continually revisit and refine both elements. This recursive process is important for maintaining focus and upholding ethical objectivity. Furthermore, the data revealed that context sensitivity should be reviewed to enhance the accuracy and applicability. For this reason, the problem should be situated within appropriate settings, stakeholders, and systems. The review also showed that the availability and feasibility of literature remain shared requirements. While RPs are presented in paragraph form and provide the broader contextual structure, RQs address the identified gaps and are typically presented separately in interrogative form.

3.4. Guiding Frameworks for the Construction of Research Problems and Questions

Table 6 below illustrates frameworks that could be utilised to structure RPs and RQs.

Table 6 ***Frameworks to be utilised to structure RPs and RQs***

Dimension	Problem Statement	Research Questions
Frameworks Commonly Used	No formal frameworks or practical tools are included; FINER and Faryadi's guiding questions are used.	Multiple established frameworks (e.g., PICO, PICo, SPIDER, SPICE) for structuring questions.
Iteration	May require refinement as context and literature evolve.	Often revised iteratively to maintain relevance and rigour throughout the research process.
Checklists & Templates	Enhance conceptual clarity, analytical precision, and identification of conceptual, empirical, or practical gaps. They support contextualisation. Explore, define, differentiate, contextualise, and justify research gaps.	Improve correctness, methodological appropriateness, contextual alignment, and accountability across qualitative, quantitative, and mixed-method studies. Provide transparency in organising primary and secondary questions to strengthen the research design and structure.

The findings indicated that frameworks are highly valuable for formulating clear and insightful research questions. Established models such as PICO(T) and SPIDER help researchers structure comprehensive and focused questions by addressing all essential components of the research design. Using the FINER framework is another highly beneficial strategy when formulating RQs, improving clarity and practicality. However, it appears that the framework's feasibility depends primarily on resource availability and engagement. Interestingly, the review identified limited literature on frameworks for developing research problems. That said, a systematic approach could be useful in this case as well, starting with problem identification, reviewing relevant literature, and labelling key concepts and variables. Understanding these constructs and their interdependencies could be enhanced by appropriate visual representations. This is an evolving process that necessitates ongoing refinement. In summary, while frameworks for research questions are well-established and demonstrably useful, their limitations and context-specific applicability must be

acknowledged. In the same way, the scarcity of formal frameworks for problem formulation underscores the need for systematic strategies to ensure clarity, feasibility, and congruency with research objectives.

The SLR demonstrated that checklists and templates are effective strategies for developing RPs and RQs in educational research. For example, the Research Problem Development Checklist can enhance conceptual clarity and analytical precision by identifying conceptual, empirical, or practical gaps in studies. Checklists encourage contextualisation of educational settings and strengthen the significance and relevance of statements. Plus, they clearly identify the target population in studies, thereby sharpening their focus. The data revealed that studies that used checklists were more manageable, focused, feasible, and aligned with the study's purpose, literature focus, methodology, and analysis. By comparison, a Problem Statement Template enables researchers to explore, define, differentiate, contextualise, and justify research gaps. Beyond this, the template enhances clarity across studies and provides structured guidance to evaluators of research projects.

Research Question Quality Checklists improve correctness, methodological appropriateness, and accountability through a range of research methods. Even more, checklists encourage the situating of questions within specific educational contexts, thereby improving interpretive clarity, sampling processes, data collection, data analysis, and redundancy. The Research Question Template provides a transparent way to organise research questions, including primary and secondary ones. It helps to improve research design and align investigations with meaningful educational phenomena and contextual factors. The template supports consistency and uniformity in structure.

4. Discussion

The results of the SLR found that, despite substantial scholarly work on RPs and RQs, the literature appears largely fragmented. It also showed signs of uneven theorisation and inconsistent terminology. On the contrary, several key patterns emerged, including greater clarity on definitions, quality criteria, strategy formulation, and the applicability of existing frameworks.

Regarding RQ 1, there was evidence that inexperienced researchers struggle to identify and articulate concise RPs and RQs. This finding aligns with Ellis and Levy's (2008) longstanding claim that this step is the most demanding in the research endeavour, a view reinforced by Kehinde (2025), who underlined that mastering the writing of an effective problem statement is essential for structuring impactful studies that attract academic or funding support. The reviewed literature confirmed that RPs and RQs work in tandem; their relationship is interdependent, a view supported by Maxwell (2013) and Ochoa-Pachas (2024), who described the two constructs as joint, interactive anchors for methodological coherence. The findings also exposed significant differences between the RP and the RQ: the research problem establishes the core issue and the need for the study (Srinivas et al., 2023), whereas the research question converts the study's motivation into specific questions (Nassaji, 2023). Furthermore, several scholars further noticed that the RP provides the bedrock for the entire study, while the RQ serves as the instrument of delimitation (Creswell & Creswell, 2018; Kross & Giust, 2019; Younas et al., 2024). That said, a noteworthy contradiction surfaced regarding the inclusion of research questions in different types of academic research. One group of scholars (Grant & Osanloo, 2014; Ravitch & Riggan, 2016; Taherdoost, 2022) averred that RQs are not always required, especially in conceptual and theoretical studies. In contrast, Aguinis (2025) and Bahishti (2022) contended that RQs are indispensable for empirical research and ensuring methodological soundness. This disagreement amongst researchers highlights an unresolved issue in the field: RQs are sometimes viewed as necessary for all types of studies and sometimes not. Despite these

conflicting views, the insights under this theme suggest that aspects of the research process generally operate and evolve iteratively. Hence, they underscore the importance of strong integration between RPs and RQs, especially in enhancing feasibility, conceptual clarity, and interpretive validity in qualitative and mixed-methods studies (Busetto et al., 2020; Purvis et al., 2024).

The evidence from the SLR indicates that dealing with complex phenomena requires multiple, interconnected questions (Han-Jing, 2023; Purvis et al., 2024), though researchers also need to be mindful of narrowing the scope to ensure a clear literature and analytic focus (Bryman et al., 2021). In line with the view that RPs and RQs are critical components of research, formulation is vital. Therefore, Stevens (2024) emphasised the use of clear, precise, unambiguous language, while Kehinde (2025) warned that a poorly defined problem risks an unfocused, overly broad, or irrelevant study that becomes a quagmire. Overall, these findings converge on a key insight: thoughtfully crafted RPs and RQs serve as conceptual anchors that strengthen coherence across studies.

Regarding RQ 2, the SLR findings confirmed that educational research problems arise from multidimensional factors, including prior studies, study replication, educational debates, policy dynamics, and real-world educational and societal challenges (Akhidime, 2017; Madhu et al., 2024; Machimbidzofa, 2025). Complimenting this standpoint, Barrios et al. (2024, p. 377) argued that scholars should: “Begin a diagnosis of the current situation. That is, identify the facts or situations that are observed when analysing the object of the research (these are the symptoms of the problem)”. The data also highlighted the distinction between practical and conceptual problems, as noted by Creswell and Creswell (2017) and Booth et al. (2016). These perspectives imply the need for deeper engagement with the literature—a point reinforced by Creswell and Creswell (2018), confirming further the need to stay abreast of current scholarship. Also, Hart (2018) and Machi and McEvoy (2016) stressed the importance of identifying knowledge gaps and immersing oneself in the existing literature. Although these perspectives predominantly emphasise systematic, literature-driven approaches, other researchers have alluded to the value of informal, practice-based approaches, such as professional experiences and media reports (Wolhuter in Okeke & Van Wyk, 2015). This indicates that the process is not always systematic but sometimes depends on context.

In addressing RQ 3, the SLR underscored the foundational role of RPs and RQs. Creswell and Creswell (2018) acknowledged that RPs identify significant gaps, while RQs target specific components to guide investigation. Regarding the nature of knowledge gaps, Abdallah (2024, p. 2) observed: “It is not merely a lack of information but a situation where existing knowledge is insufficient or inconclusive to address a particular issue”. Barrios et al. (2024) coined the term “research problem question,” which they regard as the guiding pillar of any scientific study (Barrios et al., 2024). These views underline the critical importance of strong RP and RQ development. Kehinde (2025), for instance, cautioned that a weak RP jeopardises the entire study. In support of this view, Creswell (2015, p. 4) stressed: “Identifying a research problem consists of specifying an issue to study, developing a justification for studying it, and suggesting the importance of the study for select audiences”.

The SLR also identified interesting similarities between RPs and RQs. For example, both constructs require precise formulation, feasibility, and clear theoretical or practical relevance. Moreover, refinement seems critical to maintaining focus and upholding ethical objectivity. Another key finding is the vital role of contextual sensitivity; Abdallah (2024), for example, explained that situating RPs within relevant settings and the literature enhances accuracy and applicability. As Kehinde (2025, p. 95) noted: “Tailor the problem to one’s specific field, region, or sector”. Stevens (2024) contextualised inclusion and justification, while Abdallah (2024) emphasised the need for contextualised educational environments. However, it should be noted that while the RP is positioned by many

scholars as the bedrock for conducting research (Charles et al., 2016; Han-Jing, 2023; Pardede, 2018; Rahman et al., 2022; Stevens, 2024), others contradict the idea and prioritise RQs or aims as the main drivers of scholarly enquiry (Jansen in Maree, 2019; Parathasarathy et al., 2023). These opposing views revealed a contradiction in the literature over what really constitutes the foundation of research design. This uncertainty emphasises the need for a framework that positions each element, RP, RQ and aims more clearly in research studies. Collectively, these findings also underscore the necessity for systematic, context-responsive strategies to promote scientific rigour when crafting problems and questions.

RQ 4 of the SLR explored the use of frameworks and checklists in developing and evaluating RPs and RQs. Frameworks seem highly beneficial for strengthening accord among research questions, literature selection, and methods. This view is confirmed by Munn et al. (2018, p. 3), claiming that frameworks may assist in "investigating the experience or meaningfulness of a particular phenomenon". The SLR identified various frameworks for various study types and purposes: PICOT/PICO/PECODR for quantitative or interventional studies; SPIDER/PCC/PEO for qualitative or mixed-methods research (Covvey et al., 2024); and SPICE/ECLIPSE for policy, service, or contextual inquiries. It should be noted, though, that while frameworks such as the PICO(T) and PECODR are promoted as invaluable for quantitative research, their components may not be suitable for all quantitative studies. In addition, with their emphasis on context, the SPICE and ECLIPSE may be unsuitable for other academic inquiries. The FINER framework proved useful as an evaluation tool (Han-Jing, 2023; Covvey et al., 2024), but the requirement for iterative revision during research question development (Mahesh, 2024) may pose challenges given the framework's fixed nature.

There is a paucity of literature on frameworks for problem formulation, though Faryadi's (2012) questions are among the few structured options. In this regard, researchers also hold conflicting views on the criteria for structuring PSs. The one suggested by Kehinde (2025) focuses on the ideal state and its related consequences, which may create a misalignment between a theoretically sound problem statement and a practically fragmented one. Unlike Kehinde's aspirational orientation, Faryadi's framework foregrounds contextual specificity and targeted questioning, thereby offering a more grounded mechanism for transforming an observed gap into a coherent, researchable statement. This contrast highlights the broader disagreements in the literature: whether PSs should be constructed from an idealised vision of what should be, or from a rigorous unpacking of what currently is. Additionally, the RP is generally viewed as a construct that should address a clear gap within a well-defined context (Akdime, 2017; Creswell & Creswell, 2018; Stevens, 2024). This framing is broad and may contradict the idea of manageability. Another point of disagreement among scholars is the criteria used in the structured approach. The SPIDER, PCC, PEO, and PFO frameworks are beneficial for question formulation (Covvey et al., 2024; Hosseini et al., 2024), contradicting the literature, which claims that qualitative studies prioritise flexibility in research.

Complementing the value of these frameworks, checklists, and templates emerged as powerful aids that enhance clarity, focus, and coherence in studies. The SLR findings revealed several other benefits. Studies using checklists produced more manageable, feasible, and ethically grounded problem statements (Aityan, 2022; Terrell, 2022). These tools reduce conceptual drift and promote coordination, a notion echoed by Ochoa Pachas (2024) and Younat et al. (2024). In addition, they also help identify theoretical, conceptual, empirical, or practical gaps (Institute of Education Sciences et al., 2013; Barroga & Matanguihan, 2022; Creswell & Creswell, 2017; Purvis et al., 2024). Furthermore, Abdallah (2024) highlighted their role in clarifying knowledge gaps and addressing insufficient or

inconclusive knowledge. Checklists also clarify target populations and intended audiences, as emphasised by Stevens (2024).

Despite these advantages, the SLR also reflects contradictory views on the value of checklists and templates. Besides the advantages described elsewhere, some scholars, such as Supino & Epstein (2012), view them as mechanisms that enhance the relevance of problem statements at the theoretical, practical, and policy levels. Other proponents, such as Charles et al. (2016), highlighted their value for aligning problems, purposes, questions, and the study's methods, while Stevens (2024) emphasised their value for contextualisation. In contrast, critics caution that adherence to templates may hamper originality and oversimplify complex educational problems. This prescriptive nature, in turn, may risk sound intellectual engagement in favour of compliance. It may also hamper critical reasoning and creativity, a prerequisite for quality educational research.

4.1. Limitations and Sensitivity of Findings

Although this review provides a comprehensive synthesis of the distinctions between research problems and research questions, several limitations should be acknowledged. These include issues related to the sensitivity of the findings, the methods, and the disciplinary and conceptual contexts. For instance, research questions are generally stronger within structured research designs, whereas in other approaches, they may evolve during data collection. Therefore, research problems and research questions differ in ordering and degree of formalisation. Besides, this point indicates that the applicability of the findings is methodologically sensitive. This, in turn, requires careful interpretation across different paradigms. Second, although the review focused predominantly on education, very little literature on formal research frameworks in education was found. This forced the researchers to draw on work from the social sciences and the health professions. Although this approach enhances transferability across research contexts, disciplinary differences may influence how problems and questions are formulated, operationalised, and applied in practice. Also, the scarcity of formal frameworks is sensitive to the breadth of their definitions. Consequently, there is a need for standardisation and explicit guidance for problem-formulation tools. Third, the review's sensitivity analysis revealed that poor formulation has the greatest impact on novice researchers. Challenges with formulation often lead to inconsistency, which subsequently may result in disorganisation, methodological irregularity, or even diminished rigour. Lastly, the conclusions regarding the risks of pursuing multiple problems or questions may also present challenges. While large-scale studies may require multiple questions, small studies have a narrower focus. This difference in focus necessitates that researchers apply findings with consideration of the study's scale, complexity, and purpose.

4.2. Directions for Future Research

Future research could examine the most common sources of research problems in education and investigate the impact of well-defined research problems on research outcomes. It would also be valuable to explore how the context in which research problems are situated influences their formulation and outcomes. Furthermore, future studies could focus on designing frameworks for research problems and investigating the benefits and limitations of using structured frameworks for developing research problems and questions. Finally, comparing the outcomes of studies that focus on practical research problems with those that address theoretical ones would contribute significantly to the existing body of knowledge in this field.

4.3. Implications for Practice

Supervisors and postgraduate researchers can use an alignment matrix during the research process

to ensure focus and coherence, following the sequence of problem, purpose, questions, methods, and analysis. In addition, supervisors should apply a neutrality checklist to reduce bias in studies, which may include avoiding value-laden adjectives, ensuring terminological consistency, and supporting the accurate interpretation of evidence. It is also recommended that researchers utilize frameworks appropriately, such as PICO(T)/PECODR for interventional and quantitative contexts, and SPIDER/PEO/PCC/SPICE for qualitative, mixed, and evaluation contexts. Finally, using problem and question guidance templates and checklists, along with rubric-based assessment of research questions and problems, can further enhance the quality and rigor of the research process.

4.4. Conclusion

This systematic review, drawing on two decades of research, aimed to clarify the distinction between the problem statement and the research question in education. The review revealed that these two constructs are often approached interchangeably in practice. Yet, they serve different purposes. The findings confirmed that they mutually reinforce the research design's purposes. It was found that the research problem establishes the significance, context, and rationale for the study. The research question, by contrast, draws from the problem to guide the research into a focused line of investigation. Poorly formulated problems and questions lead to conceptual and methodological vagueness and drift, resulting in shallow analyses. Also, the SLR revealed that research problems stem from several conceptual, contextual, and policy-driven sources. Hence, it requires thoughtful, intentional justification and delimitation. Research questions, by comparison, operationalise these problems. They, in turn, demand precision and feasibility. Scholars emphasised the need for clear criteria as a prerequisite for developing and formulating strong research questions. The criteria that emerged were clarity, relevance, feasibility, context sensitivity, ethical appropriateness, and synergy. It was also recorded that several frameworks exist for question development. In contrast, the literature on formal tools to guide the formulation of research problems appears scarce. This paucity indicates a significant gap in this area of scholarship, underscoring the need for greater attention to problem formulation. The study also revealed practical tools that offer support for research problem and question writing. These include checklists and templates that scaffold the writing process. On a methodological level, the review underlined the importance of iterative refinement, emphasising the pursuit of stringent congruence among the title, problem, questions, methods, and findings. In conclusion, this review reaffirms that conceptual clarity and rigour are critical in producing meaningful, coherent, and impactful research. Through explicit criteria, synergy strategies, and relevant frameworks, scholarly practice can be improved, and novice researchers empowered. Therefore, ongoing research is required to develop formal tools for problem formulation to promote high-quality educational inquiry.

5. Declarations

5.1. Author Contributions (CRediT)

The authors confirm contribution to the paper as follows: Study conception and design: BP, AP; conceptual framework, method, findings, and discussion: BP; introduction, literature review, and review of the method section: AP; draft manuscript preparation: BP, AP. The authors reviewed the results and approved the final version of the article. Both authors have agreed to be accountable for all aspects of the work, ensuring its accuracy and integrity in accordance with their respective author contributions.

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The authors declare no conflicts of interest.

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5.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

5.5. Ethics Approval

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Examining the future and occupational anxiety of preschool teacher candidates

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ABSTRACT

This study examined the relationship between future anxiety and occupational anxiety among preschool teacher candidates. A correlational survey design was employed. The sample comprised 225 teacher candidates enrolled in the Preschool Education Department of the Faculty of Education at a state university. Data were collected using a Demographic Information Form, the Future Anxiety Scale for University Students, and the Occupational Anxiety Scale for Prospective Teachers. All measures were completed individually via an online platform. Results indicated that fear of the future, hopelessness about the future, and overall future anxiety were positively and significantly associated with all eight dimensions of occupational anxiety (task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and school management-centred anxiety). Higher levels of fear of the future and hopelessness about the future were accompanied by higher levels of occupational anxiety, whereas lower levels were accompanied by lower occupational anxiety. Overall, future anxiety showed the strongest association with economic-social-centred anxiety and the weakest association with student communication-centred anxiety. Regression analyses further showed that fear of the future, hopelessness about the future, and overall future anxiety significantly predicted each dimension of occupational anxiety. Overall, future anxiety most strongly predicted economic-social-centred anxiety and least strongly predicted student communication-centred anxiety. Taken together, these findings indicate that future anxiety is closely linked to how teacher candidates perceive and anticipate their professional lives.

KEYWORDS: Future anxiety; Occupational anxiety; Teacher candidates; Preschool teaching; Early childhood.

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1. Introduction

Early childhood education (ECE) represents a critical phase in children's cognitive, affective, and social development and shapes foundational learning habits (UNESCO, 2010). The quality of experiences provided during this period has long-term implications for children's later academic achievement and psychosocial well-being. Within this context, preschool teachers play a pivotal role in the educational process (Kunt & Avcı, 2023). They act not only as instructors but also as guides who foster curiosity, intrinsic motivation, and positive attitudes towards lifelong learning. Accordingly, the effectiveness of ECE is closely linked to teachers' professional competence, emotional well-being,

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and psychological readiness (Einarsdottir, 2014). Beyond being a pedagogical choice, the critical role of ECE is increasingly recognised as a cornerstone of children's right to a strong foundation and a key component of efforts to promote equity in education. In recent years, particular emphasis has been placed on the quality, stability, and well-being of the ECE workforce as central determinants of provision. Contemporary global reports indicate that initiatives to strengthen quality in ECE are directly tied to educators' working conditions, the attractiveness of the profession, entry into the sector, retention dynamics, and early-career support mechanisms (OECD, 2020; UNESCO & UNICEF, 2024). Therefore, teacher candidates' perceptions of the future and their occupational anxieties should be understood not merely as individual-level variables, but also as structural indicators that may influence the sustainability of quality in ECE.

Preschool teachers are expected to possess current professional knowledge and a broad repertoire of skills, including classroom management, effective communication, and a sound understanding of children's developmental characteristics (Cheung, 2020; Köksal Akyol, 2012). They are also responsible for designing learning environments that stimulate curiosity and support the development of essential psychosocial skills and motivation to learn (Pianta et al., 2009). Among the many determinants of educational quality, teacher characteristics have been identified as particularly influential (Schmitt et al., 2023). In this regard, variables such as occupational anxiety, life satisfaction, and future expectations can shape instructional practices and the quality of teacher–child interactions (Gülbahar, Kuzu, & Sıvacı, 2023). Within ECE, teachers' emotional well-being and occupational stress are closely linked to child outcomes through their influence on the quality of classroom interactions. Evidence from research conducted in the Head Start context indicates that workplace stress can be negatively associated with the quality of teacher–child relationships (Whitaker, Dearth-Wesley, & Gooze, 2015). Similarly, systematic reviews examining teacher burnout emphasise that high levels of stress and burnout are associated with an increased likelihood of leaving the job or exiting the field, which may, in turn, pose risks to continuity and quality in children's early learning experiences (Ng, Rogers, & McNamara, 2023). International teacher surveys likewise report that a substantial proportion of the ECE workforce feels highly stressed, with workload and working conditions frequently cited as prominent sources of stress (OECD, 2025). From this perspective, understanding the anxiety experienced by teacher candidates is important not only for individual adjustment but also as a preventive approach to sustaining quality in ECE.

Teaching is widely recognised as an emotionally demanding profession. Evidence suggests that teachers report higher levels of stress, anxiety, and emotional exhaustion than many other occupational groups (İşli, 2023). Preschool teachers, who work with younger children and engage in sustained communication with families, often require additional support in areas such as self-care, emotional regulation, and continuous professional development. These demands may contribute to both the intensity and the multidimensional nature of their occupational anxiety (Ada & Erdaş Kartal, 2020). Importantly, the quality of ECE is shaped not only by in-service teachers but also by the professional preparation of teacher candidates, whose training experiences can be decisive for later practice (Sağlam, Çelik, & Tunç, 2024). The constructs addressed in this study—occupational anxiety and future anxiety—can be understood through a shared explanatory lens. Under conditions of uncertainty, anxiety may increase when individuals perceive their personal resources (e.g., time, financial security, status, perceived control, and perceived competence) as insufficient. For preschool teacher candidates, expectations regarding job security, the likelihood of appointment, economic independence, and professional status may be key stressors shaping future-oriented cognitive appraisals. In the international literature on the ECE workforce, factors such as pay,

opportunities for progression, and working conditions have been linked to the attractiveness of the profession and intentions to remain in the field, suggesting that these issues can generate anticipatory anxiety as early as the preservice period (OECD, 2020). Therefore, considering future anxiety and occupational anxiety together may offer meaningful explanatory power at both psychological and structural levels.

Occupational anxiety refers to the concerns that teacher candidates experience regarding the professional roles, responsibilities, and challenges they may encounter upon entering the teaching profession. Research suggests that such anxiety commonly centres on classroom management, instructional effectiveness, assessment practices, and relationships with colleagues and families (Ada & Erdaş Kartal, 2020; Morton et al., 1997). For example, Morton et al. (1997) reported that trainee teachers in Britain experienced high levels of anxiety related to pupil discipline, teaching methods, and professional relationships. Taken together, these findings indicate that occupational anxiety can emerge early in the professional trajectory and may influence both professional development and teaching quality.

Alongside occupational anxiety, future anxiety constitutes another critical psychological factor affecting teacher candidates. Future anxiety has been defined as a dispositional tendency that differs from conventional conceptualisations of anxiety in that it is characterised by longer-term negative expectations about the future, perceptions of uncertainty, and a cognitive orientation towards adverse future scenarios (Zaleski, 1996). Work on the assessment of this construct suggests that future-oriented anxiety is not merely a transient affective state; rather, it reflects a cognitive pattern through which individuals represent the future primarily in terms of threat and risk (Zaleski et al., 2017). It is characterised by apprehension regarding potential negative changes in both the short and long term (Jannini et al., 2024). Within the teaching profession, future anxiety is often intertwined with concerns about employment, professional competence, and career sustainability (Gerçek, 2018).

In the Turkish context, future anxiety among teacher candidates is strongly shaped by structural and economic conditions. Graduates of faculties of education are required to take the Public Personnel Selection Examination (KPSS) and subsequently undergo an interview process to be appointed to public schools. This competitive and uncertain pathway constitutes a major source of stress and anxiety (Bulut & Yıldırım, 2020). Empirical studies consistently report that concerns related to the KPSS, appointment procedures, and post-graduation unemployment are among the most salient sources of anxiety for teacher candidates (Bulut & Yıldırım, 2020; Özcan, 2019). The prospect of unemployment, economic insecurity, and an inability to practise one's profession may undermine candidates' motivation, psychological well-being, and overall quality of life. Beyond individual aspirations, teacher candidates' perceptions of the future and employment prospects in Türkiye are also shaped by the state's employment capacity and broader youth labour-market indicators. For example, in the 2025 recruitment of contracted teachers, the Ministry of National Education allocated 1,321 posts to preschool teaching, suggesting that appointment competition may constitute a salient pressure even within early childhood education (MEB, 2025). In addition, official labour market bulletins indicate that unemployment among those aged 15–24 has remained in the double digits (ÇSGB, 2025). This structural context provides a critical background for understanding preschool teacher candidates' uncertainty about the future and their concerns about sustaining a foothold in the profession.

Research focusing on preschool teacher candidates suggests that levels of occupational and future anxiety vary according to factors such as academic achievement, psychological well-being, career planning, perceived professional readiness, and post-graduation employment opportunities (Arslan,

Tunca Güçlü, & Alkın Şahin, 2023; Geylani & Çiriş Yıldız, 2022; Gümrükçü Bilgici & Deniz, 2016). Individual characteristics, limited professional experience, and perceived inadequacies in pedagogical knowledge have also been identified as significant contributors to anxiety (Külekçi Akyavuz, 2021). In addition, economic conditions have been shown to play a decisive role in shaping young people's future expectations in Türkiye, potentially intensifying future anxiety (Yücel & Buz, 2023).

Future anxiety, like occupational anxiety, has important implications for teacher candidates' psychological well-being. In a study involving 1,024 university students, Öztekin (2025) found that future anxiety was negatively associated with optimism and positively associated with pessimism. Optimism and pessimism were also found to mediate the relationship between future anxiety and well-being, suggesting that elevated future anxiety may erode students' psychological resilience and overall well-being.

Although numerous studies in Türkiye have examined teacher candidates' occupational and future anxiety separately (Cabı & Yalçınalp, 2013; Gümrükçü Bilgici & Deniz, 2016), the literature indicates a notable gap in research on the association between these constructs, particularly among preschool teacher candidates. While prior work has focused on demographic characteristics, self-efficacy beliefs, and professional perceptions (Akgün & Özgür, 2014; Apayıdın Demirci & Arslan, 2020; Recep oğlu, Erdaş, & Aşıkuzun, 2017), the relationship between occupational anxiety and future anxiety has received limited empirical attention. Accordingly, examining the association between these two forms of anxiety among preschool teacher candidates constitutes a central contribution and an element of originality in the present study.

1.1. Problem Statement

The future anxiety and occupational anxiety experienced by preschool teacher candidates are critical for both educational quality and individual psychological well-being. When these anxieties reach elevated levels, they may diminish candidates' professional motivation, adversely affect academic achievement, and hinder readiness for the teaching profession. The literature consistently documents the detrimental effects of anxiety on performance, achievement, and both physical and psychological health. By contrast, teacher candidates with lower anxiety levels tend to report greater confidence in fulfilling their professional responsibilities (Adıgüzelli, 2015).

From both individual and societal perspectives, it is therefore essential to examine teacher candidates' views and experiences regarding future and occupational anxiety. Expanding the number of studies in this field and diversifying the variables examined may contribute to the evaluation and improvement of teacher education programmes and teacher employment processes. Aydın Yıldız (2024) emphasised the need for further research to effectively support teacher candidates during their professional preparation. In addition, such research may pave the way for experimental studies aimed at enhancing teacher candidates' psychological well-being. In this respect, the present study is significant in drawing attention to the issue and encouraging further research in this area.

1.2. Aim and Significance of the Study

The aim of this study is to examine the relationship between future anxiety and occupational anxiety among preschool teacher candidates. By focusing on these two constructs simultaneously, the study seeks to contribute to the existing literature by addressing a relationship that has not been sufficiently explored in previous research.

The specific research questions guiding the study are as follows:

1. Is there a statistically significant relationship between preschool teacher candidates' fear of the future and the types of occupational anxiety, namely task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and school management-centred anxiety?
2. Does fear of the future significantly predict the types of occupational anxiety, including task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and school management-centred anxiety?
3. Is there a statistically significant relationship between preschool teacher candidates' hopelessness about the future and the types of occupational anxiety, namely task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and school management-centred anxiety?
4. Does hopelessness about the future significantly predict the types of occupational anxiety, including task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and school management-centred anxiety?
5. Is there a statistically significant relationship between preschool teacher candidates' future anxiety and the types of occupational anxiety, namely task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and school management-centred anxiety?
6. Does future anxiety significantly predict the types of occupational anxiety, including task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and school management-centred anxiety?

2. Method

2.1. Research Design

This study employed a correlational survey design, a descriptive research method. Correlational survey designs are used to examine the relationships, directions, and degrees of association between two or more variables without manipulating them (Creswell, 2017). In the present study, this design was considered appropriate for investigating the relationship and predictive effect between future anxiety and occupational anxiety among preschool teacher candidates.

2.2. Participants and Procedure

A convenience sampling strategy was used to recruit participants. This approach, commonly employed in educational research, involves selecting readily accessible individuals who are willing to participate. The sample comprised 225 teacher candidates enrolled in the Preschool Education Department of the Faculty of Education at a state university.

The sample size was determined in line with methodological guidance for survey and correlational research. In the social sciences, samples of 200 or more are often considered sufficient to support reliable statistical analyses (Creswell & Creswell, 2018). Tabachnick and Fidell (2013) also note that samples exceeding 200 participants generally provide adequate statistical power to detect medium-

sized effects in correlational designs. Similarly, Field (2018) suggests that samples of more than 100 are acceptable for regression analyses, with larger samples yielding more stable and robust estimates. Accordingly, the sample of 225 preschool teacher candidates in the present study is methodologically adequate for the analyses conducted. Participants' demographic characteristics are presented in Table 1.

Table 1 ***Demographic Information of Teacher Candidates Participating in the Study***

	N	%
Gender	Female	175
	Male	50
	Total	225
Age	18–23	205
	24–27	15
	28–31	4
	32 and above	1
	Total	225
Year of study	First year	67
	Second year	70
	Third year	49
	Fourth year	39
	Total	225
University Entrance Attempt	First Attempt	74
	Second Attempt	113
	Third Attempt	34
	Fourth or more	4
	Total	225
Preference for the Department	Willingly	162
	Unwillingly	11
	Partially Willingly	52
	Total	225

2.3. Data Collection Instruments

2.3.1. Personal Information Form

The Personal Information Form was developed by the researchers to collect demographic and background information about the participants. The form included items related to gender, age, year of study, number of attempts at the university entrance examination, willingness to choose the department, willingness to continue in the department, and post-graduation career plans.

2.3.2. Future Anxiety Scale for University Students

The Future Anxiety Scale for University Students was developed by Geylani and Çiriş Yıldız (2022). The scale comprises 19 items rated on a five-point Likert scale and includes two factors: Fear of the Future and Hopelessness about the Future. In the original study, Cronbach's alpha was reported as .91 for the total scale, .95 for the Fear of the Future factor, and .88 for the Hopelessness about the Future factor. The scale contains six reverse-scored items (Items 2, 4, 6, 8, 10, and 12). Higher total scores indicate higher levels of future anxiety, whereas lower scores reflect lower levels of future anxiety (Geylani & Çiriş Yıldız, 2022). In the present study, internal consistency was .92 for the total scale. For the subscales, Cronbach's alpha was .92 for Fear of the Future and .82 for Hopelessness about the Future.

2.3.3. Occupational Anxiety Scale for Prospective Teachers

The Occupational Anxiety Scale for Prospective Teachers was developed by Cabı and Yalçınalp (2013). The scale comprises 45 items rated on a five-point Likert scale and includes eight dimensions: task-centred anxiety, economic-social-centred anxiety, student communication-centred anxiety, peer and parent-centred anxiety, personal development-centred anxiety, appointment-centred anxiety, adjustment-centred anxiety, and school management-centred anxiety. In the original validation study, Cronbach's alpha coefficients for the subscales ranged from .67 to .94, and the overall reliability coefficient was reported as .95 (Cabı & Yalçınalp, 2013). In the present study, internal consistency estimates (Cronbach's alpha) for the subscales were as follows: task-centred anxiety, .94; economic-social-centred anxiety, .88; student communication-centred anxiety, .90; peer and parent-centred anxiety .87, personal development-centred anxiety .88; appointment-centred anxiety, .79; adjustment-centred anxiety, .71; and school management-centred anxiety, .78.

2.4. Data Analysis

The data were analysed using IBM SPSS Statistics (version 20). Prior to the main analyses, the assumption of normality was examined. The results indicated that the data were approximately normally distributed; therefore, parametric statistical procedures were used. Skewness and kurtosis values within the range of −1.5 to +1.5 were considered an acceptable approximation to normality, in line with the criteria suggested by Tabachnick and Fidell (2013).

Pearson's product–moment correlation coefficient was used to examine the relationships between future anxiety and occupational anxiety and its sub-dimensions. In addition, simple linear regression analyses were conducted to assess the extent to which future anxiety predicted the dimensions of occupational anxiety. To interpret the strength of the relationships between variables, Büyüköztürk's (2021) classification was adopted, whereby correlation coefficients between 0.00 and 0.30 were considered low, those between 0.30 and 0.70 moderate, and those above 0.70 high. The results of the normality analyses are presented in Table 2.

Table 2 ***Normality Analysis Results***

Variables	Skewness	Kurtosis
Future Anxiety	.061	.323
Fear of the Future	.227	-.140
Hopelessness about the Future	.348	.151
Task-Centred Anxiety	.034	-1.419
Economic-Social-Centred Anxiety	.710	-.673
Student Communication-Centred Anxiety	.314	-1.365
Peer and Parent-Centred Anxiety	-.088	-1.463
Personal Development-Centred Anxiety	.034	-1.491
Appointment-Centred Anxiety	1.219	.483
Adjustment-Centred Anxiety	.090	-1.281
School Management-Centred Anxiety	.362	-1.259

2.5. Validity, Reliability, and Ethical Considerations

Data were collected during the 2023–2024 academic year. Prior to data collection, ethical approval was obtained from the Ondokuz Mayıs University Social and Human Sciences Ethics Committee (Decision No. 2023-684; 28 July 2023). The research instruments were administered online via Google Forms. The average completion time was approximately 15–20 minutes.

Before participating, individuals were informed about the purpose of the study and the nature of the instruments, and participation was entirely voluntary. An informed consent statement was provided at the beginning of the online form, stating clearly that no personal or identifiable information would be collected. Participants completed the Demographic Information Form, the Future Anxiety Scale for University Students, and the Occupational Anxiety Scale for Prospective Teachers individually.

The reliability of the findings was supported by the internal consistency coefficients for the study's scales. As reported in the Data Collection Instruments section, the coefficients obtained in the present study were within acceptable to high ranges, indicating that the scales yielded reliable scores in this sample. Evidence of validity was drawn from the original development and validation studies, which reported satisfactory psychometric properties. Data collection took place over approximately four months and was conducted in accordance with ethical principles, including voluntary participation, confidentiality, and respect for participants' rights.

3. Findings

The results of the analyses examining the relationships between teacher candidates' Fear of the Future and the different types of occupational anxiety are presented in Table 3.

Table 3 *Correlation Analysis Between Fear of the Future and Types of Occupational Anxiety*

Variables	x̄	sd	r
Fear of the Future	38.83	10.62	
Task-Centred Anxiety	40.26	17.69	.385*
Economic-Social-Centred Anxiety	24.52	8.55	.499*
Student Communication-Centred Anxiety	18.95	8.21	.319*
Peer and Parent-Centred Anxiety	13.82	6.95	.468*
Personal Development-Centred Anxiety	11.91	5.87	.439*
Appointment-Centred Anxiety	11.98	3.40	.323*
Adjustment-Centred Anxiety	9.05	4.02	.469*
School Management-Centred Anxiety	9.77	4.17	.423*

** p<.01*

As shown in Table 3, fear of the future was positively and significantly associated with task-centred anxiety (r = .385, p < .01), economic-social-centred anxiety (r = .499, p < .01), student communication-centred anxiety (r = .319, p < .01), peer and parent-centred anxiety (r = .468, p < .01), personal development-centred anxiety (r = .439, p < .01), appointment-centred anxiety (r = .323, p < .01), adjustment-centred anxiety (r = .469, p < .01), and school management-centred anxiety (r = .423, p < .01), indicating small-to-moderate effect sizes overall. Accordingly, as preschool teacher candidates' fear of the future increases (or decreases), their occupational anxiety levels may also increase (or decrease). The results of the analyses examining the extent to which fear of the future predicts the different types of occupational anxiety are presented in Table 4.

Table 4 *Regression Analysis: Predictive Power of Fear of the Future on Occupational Anxiety Types*

Predictor	Outcome	R	R^2	F	Std. Error	β	t	p
Fear of the Future	Task-centred anxiety	.385	.148	38.777	.103	.385	6.227	.000*
	Economic-social-centred anxiety	.499	.249	74.067	.047	.499	8.606	.000*
	Student communication-centred anxiety	.319	.102	25.300	.049	.319	5.030	.000*
	Peer and parent-centred anxiety	.468	.219	62.681	.039	.468	7.917	.000*
	Personal development-centred anxiety	.439	.193	53.243	.033	.439	7.297	.000*
	Appointment-centred anxiety	.323	.104	25.952	.020	.323	5.094	.000*

Predictor	Outcome	R	R^2	F	Std. Error	β	t	p
	Adjustment-centred anxiety	.469	.220	62.933	.022	.469	7.933	.000*
	School management-centred anxiety	.423	.179	48.465	.024	.423	6.962	.000*

As shown in Table 4, preschool teacher candidates' Fear of the Future significantly predicted task-centred anxiety ($R = .385$, $R^2 = .148$, $F = 38.777$, $p < .01$), economic-social-centred anxiety ($R = .499$, $R^2 = .249$, $F = 74.067$, $p < .01$), student communication-centred anxiety ($R = .319$, $R^2 = .102$, $F = 25.300$, $p < .01$), peer and parent-centred anxiety ($R = .468$, $R^2 = .219$, $F = 62.681$, $p < .01$), personal development-centred anxiety ($R = .439$, $R^2 = .193$, $F = 53.243$, $p < .01$), appointment-centred anxiety ($R = .323$, $R^2 = .104$, $F = 25.952$, $p < .01$), adjustment-centred anxiety ($R = .469$, $R^2 = .220$, $F = 62.933$, $p < .01$), and school management-centred anxiety ($R = .423$, $R^2 = .179$, $F = 48.465$, $p < .01$). These results suggest that Fear of the Future explains approximately 15% of the variance in task-centred anxiety, 25% in economic-social-centred anxiety, 10% in student communication-centred anxiety, 22% in peer and parent-centred anxiety, 19% in personal development-centred anxiety, 10% in appointment-centred anxiety, 22% in adjustment-centred anxiety, and 18% in school management-centred anxiety. The results of the analyses examining the relationships between teacher candidates' Hopelessness about the Future and the different types of occupational anxiety are presented in Table 5.

Table 5 ***Correlation Analysis Between Hopelessness about the Future and Types of Occupational Anxiety***

Variables	x̄	sd	r
Hopelessness about the Future	14.04	4.20	
Task-Centred Anxiety	40.26	17.69	.346*
Economic-Social-Centred Anxiety	24.52	8.55	.381*
Student Communication-Centred Anxiety	18.95	8.21	.262*
Peer and Parent-Centred Anxiety	13.82	6.95	.322*
Personal Development-Centred Anxiety	11.91	5.87	.348*
Appointment-Centred Anxiety	11.98	3.40	.287*
Adjustment-Centred Anxiety	9.05	4.02	.431*
School Management-Centred Anxiety	9.77	4.17	.296*

As shown in Table 5, Hopelessness about the Future was positively and significantly associated with task-centred anxiety ($r = .346$, $p < .01$), economic-social-centred anxiety ($r = .381$, $p < .01$), student communication-centred anxiety ($r = .262$, $p < .01$), peer and parent-centred anxiety ($r = .322$, $p < .01$), personal development-centred anxiety ($r = .348$, $p < .01$), appointment-centred anxiety ($r = .287$, $p < .01$), adjustment-centred anxiety ($r = .431$, $p < .01$), and school management-centred anxiety ($r = .296$, $p < .01$), with effect sizes ranging from small to moderate. Accordingly, as preschool teacher candidates' Hopelessness about the Future increases (or decreases), their occupational anxiety

levels may also increase (or decrease). The results of the analyses examining the extent to which Hopelessness about the Future predicts the different types of occupational anxiety are presented in Table 6.

Table 6 ***Regression Analysis: Predictive Power of Hopelessness about the Future on Occupational Anxiety Types***

Predictor	Outcome	R	R^2	F	Std. Error	β	t	p
Hopelessness about the Future	Task-centred anxiety	.346	.120	30.393	.119	.346	5.513	.000*
	Economic-social-centred anxiety	.381	.145	37.908	.064	.381	6.157	.000*
	Student communication-centred anxiety	.262	.069	16.424	.069	.262	4.053	.000*
	Peer and parent-centred anxiety	.322	.104	25.880	.053	.322	5.087	.000*
	Personal development-centred anxiety	.348	.121	30.634	.045	.348	5.535	.000*
	Appointment-centred anxiety	.287	.082	19.990	.028	.287	4.471	.000*
	Adjustment-centred anxiety	.431	.186	50.808	.031	.431	7.128	.000*
	School management-centred anxiety	.296	.088	21.467	.033	.296	4.633	.000*

As shown in Table 6, preschool teacher candidates' Hopelessness about the Future significantly predicted task-centred anxiety ($R = .346$, $R^2 = .120$, $F = 30.393$, $p < .01$), economic-social-centred anxiety ($R = .381$, $R^2 = .145$, $F = 37.908$, $p < .01$), student communication-centred anxiety ($R = .262$, $R^2 = .069$, $F = 16.424$, $p < .01$), peer and parent-centred anxiety ($R = .322$, $R^2 = .104$, $F = 25.880$, $p < .01$), personal development-centred anxiety ($R = .348$, $R^2 = .121$, $F = 30.634$, $p < .01$), appointment-centred anxiety ($R = .287$, $R^2 = .082$, $F = 19.990$, $p < .01$), adjustment-centred anxiety ($R = .431$, $R^2 = .186$, $F = 50.808$, $p < .01$), and school management-centred anxiety ($R = .296$, $R^2 = .088$, $F = 21.467$, $p < .01$). These results suggest that Hopelessness about the Future explains approximately 12% of the variance in task-centred anxiety, 15% in economic-social-centred anxiety, 7% in student communication-centred anxiety, 10% in peer and parent-centred anxiety, 12% in personal development-centred anxiety, 8% in appointment-centred anxiety, 19% in adjustment-centred anxiety, and 9% in school management-centred anxiety. The results of the analyses examining the relationships between preschool teacher candidates' future anxiety and the different types of occupational anxiety are presented in Table 7.

Table 7 ***Correlation Analysis Between Future Anxiety and Types of Occupational Anxiety***

Variables	x̄	sd	r
Future Anxiety	52.88	13.32	
Task-Centred Anxiety	40.26	17.69	.416*

Variables	x̄	sd	r
Economic-Social-Centred Anxiety	24.52	8.55	.518*
Student Communication-Centred Anxiety	18.95	8.21	.337*
Peer and Parent-Centred Anxiety	13.82	6.95	.475*
Personal Development-Centred Anxiety	11.91	5.87	.460*
Appointment-Centred Anxiety	11.98	3.40	.348*
Adjustment-Centred Anxiety	9.05	4.02	.510*
School Management-Centred Anxiety	9.77	4.17	.430*

As shown in Table 7, a moderate and statistically significant positive correlation was found between future anxiety and all dimensions of occupational anxiety. Specifically, future anxiety was positively associated with task-centred anxiety ($r = .416$, $p < .01$), economic-social-centred anxiety ($r = .518$, $p < .01$), student communication-centred anxiety ($r = .337$, $p < .01$), peer and parent-centred anxiety ($r = .475$, $p < .01$), personal development-centred anxiety ($r = .460$, $p < .01$), appointment-centred anxiety ($r = .348$, $p < .01$), adjustment-centred anxiety ($r = .510$, $p < .01$), and school management-centred anxiety ($r = .430$, $p < .01$). These findings indicate that increases or decreases in preschool teacher candidates' future anxiety are accompanied by corresponding increases or decreases in their occupational anxiety levels across all dimensions. The results of the analysis regarding the predictive power of future anxiety on the various types of occupational anxiety are presented in Table 8.

Table 8 ***Regression Analysis: Predictive Power of Future Anxiety on Occupational Anxiety Types***

Predictor	Outcome	R	R^2	F	Std. Error	β	t	p
Future Anxiety	Task-centred anxiety	.416	.173	46.696	.081	.416	6.833	.000*
	Economic-social-centred anxiety	.518	.269	81.937	.037	.518	9.052	.000*
	Student communication-centred anxiety	.337	.114	28.595	.039	.337	5.347	.000*
	Peer and parent-centred anxiety	.475	.226	65.047	.031	.475	8.065	.000*
	Personal development-centred anxiety	.460	.211	59.742	.026	.460	7.729	.000*
	Appointment-centred anxiety	.348	.121	30.707	.016	.348	5.541	.000*
	Adjustment-centred anxiety	.510	.260	78.361	.017	.510	8.852	.000*
	School management-centred anxiety	.430	.185	50.695	.019	.430	7.120	.000*

The results of the regression analyses examining the predictive role of future anxiety on occupational anxiety dimensions are presented in Table 8. An examination of Table 8 demonstrates that future anxiety significantly predicts all eight types of occupational anxiety. Future anxiety was found to be a significant predictor of task-centred anxiety ($R = .416$, $R^2 = .173$, $F = 46.696$, $p < .01$), economic-social-centred anxiety ($R = .518$, $R^2 = .269$, $F = 81.937$, $p < .01$), student communication-centred anxiety ($R = .337$, $R^2 = .114$, $F = 28.595$, $p < .01$), peer and parent-centred anxiety ($R = .475$, $R^2 = .226$, $F = 65.047$, $p < .01$), personal development-centred anxiety ($R = .460$, $R^2 = .211$, $F = 59.742$, $p < .01$), appointment-centred anxiety ($R = .348$, $R^2 = .121$, $F = 30.707$, $p < .01$), adjustment-centred anxiety ($R = .510$, $R^2 = .260$, $F = 78.361$, $p < .01$), and school management-centred anxiety ($R = .430$, $R^2 = .185$, $F = 50.695$, $p < .01$).

These results indicate that future anxiety explains approximately 17% of the variance in task-centred anxiety, 27% in economic-social-centred anxiety, 11% in student communication-centred anxiety, 23% in peer and parent-centred anxiety, 21% in personal development-centred anxiety, 12% in appointment-centred anxiety, 26% in adjustment-centred anxiety, and 19% in school management-centred anxiety.

4. Conclusion, Discussion, and Recommendations

The present study revealed statistically significant positive relationships between fear of the future, hopelessness about the future, and overall future anxiety and all eight dimensions of occupational anxiety examined: task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and school management-centred anxiety. The findings indicate that increases in preschool teacher candidates' fear of the future, hopelessness about the future, and overall future anxiety are accompanied by corresponding increases in occupational anxiety, whereas lower levels of these future-oriented anxiety indicators are associated with lower occupational anxiety. Among the dimensions, fear of the future and overall future anxiety showed the strongest associations with economic-social-centred anxiety and the weakest associations with student communication-centred anxiety. Hopelessness about the future was most strongly associated with adjustment-centred anxiety and least strongly associated with student communication-centred anxiety.

These correlation findings suggest that the observed relationships are not only statistically significant but also meaningful in practical terms. The regression results further support this pattern. In particular, the relatively higher proportions of explained variance in dimensions such as economic-social-centred anxiety and adjustment-centred anxiety—both of which are closely tied to everyday life circumstances and the transition into the profession—indicate that future-oriented uncertainty may contribute to occupational anxiety in a multidimensional manner among preschool teacher candidates.

Given that the youth unemployment rate in Türkiye was reported as 15.1% in March 2025 and that only 1,321 posts were allocated to preschool teaching in the 2025 recruitment cycle, it is unsurprising that economic-social-centred anxiety emerged as the most salient concern among preschool teacher candidates (Millî Eğitim Bakanlığı [MEB], 2025; Türkiye İstatistik Kurumu [TÜİK], 2025). These findings indicate that teacher candidates' anxieties should be understood not only in relation to individual characteristics but also in light of a quota-based and highly competitive public employment structure. The persistence of double-digit youth unemployment can be viewed as a structural indicator that intensifies uncertainty during the transition into the profession (TÜİK, 2025). Similarly, the allocation of 1,321 posts for preschool teaching within the 2025 recruitment of 15,000 contracted

teachers provides a concrete context for why appointment-related and economic-security concerns may become particularly pronounced (MEB, 2025).

Consistent with this pattern, Teke and Koç (2017) reported that teacher candidates experience heightened anxiety related to post-graduation appointments, difficulties in transferring knowledge to pupils, and difficulties in establishing classroom authority. Likewise, Koşar (2018) found that candidates' primary concerns centred on economic conditions and communication with school administrators, parents, pupils, and colleagues. Özcan (2019) similarly noted that appointment-related anxiety is a prevalent source of concern among teacher candidates.

The findings are consistent with theoretical accounts that interpret teacher candidates' anxiety through the lens of uncertainty about the future. Conservation of Resources theory conceptualises stress and anxiety as arising, in part, from anticipated or actual losses of valued resources such as financial security, status, social support, time, and energy (Hobfoll, 1989). In professions that involve high levels of emotional labour, such as teaching, perceptions of threatened resources may intensify not only concerns about entry into the profession and appointment but also anxieties about workload, perceived professional competence, and relational responsibilities. In addition, uncertainty-based explanations highlight fear of the unknown as a transdiagnostic component of anxiety, which may help to account for why future-oriented threat appraisals generalise across multiple domains of occupational anxiety (Carleton, 2016).

The predictive analyses conducted in this study demonstrated that fear of the future, hopelessness about the future, and overall future anxiety significantly predicted all dimensions of occupational anxiety. Among these predictors, fear of the future and overall future anxiety most strongly predicted economic-social-centred anxiety and least strongly predicted student communication-centred anxiety. Hopelessness about the future most strongly predicted adjustment-centred anxiety and least strongly predicted student communication-centred anxiety. These results underscore the considerable influence of future-oriented concerns on teacher candidates' professional perceptions, particularly regarding economic security and employment prospects. Previous research aligns with these findings, indicating that rising unemployment and economic uncertainty are associated with heightened anxiety among young people in Türkiye (Koç, Bayramoğlu, & Koç, 2024; Rüzgar & Cura, 2023). Similarly, Lin et al. (2017) reported elevated anxiety among teacher candidates in China, attributed to increasingly competitive labour-market conditions. Güçlü, Abbak, and Toprak (2023) found that higher unemployment anxiety was negatively associated with teacher candidates' attitudes towards the profession. International evidence likewise suggests that teacher candidates across contexts experience substantial anxiety about their professional futures. For instance, Keller et al. (2014) reported that candidates who perceive themselves as inadequately prepared for teaching tend to experience higher anxiety, whereas Mapfumo, Chitsiko, and Chireshe (2012) observed that teacher candidates in Zimbabwe entered teaching practice with enthusiasm but reported increasing stress and anxiety over time. In the context of early childhood education and care (ECEC), these findings should not be considered solely in terms of individual well-being. Anxieties experienced during teacher preparation may trigger a chain of effects that extend into the transition into the profession, shaping burnout risk, intentions to remain in the field, and the quality of classroom interactions that ultimately influence children's experiences. Meta-analytic evidence linking teacher burnout to intentions to leave the profession suggests that anxiety during the pre-service period may be critical for workforce stability (Madigan & Kim, 2021). OECD reports focusing on the early childhood workforce similarly emphasise that working conditions, well-being, and stress are key

determinants in maintaining and strengthening the quality of the ECEC workforce (OECD, 2020; OECD, 2025).

The finding that overall future anxiety most strongly predicted economic-social-centred anxiety is consistent with the existing literature. By contrast, the relatively weak predictive effect of future anxiety on student communication-centred anxiety may be attributed to the scope and structure of preschool teacher education programmes. Throughout the four-year undergraduate curriculum, teacher candidates receive both theoretical and practice-oriented preparation in areas such as classroom management, effective communication with young children, and facilitating social skills. Such coursework is intended to develop the competencies required for constructive, developmentally appropriate interactions with children. Consistent with this interpretation, previous studies have reported that teacher candidates generally demonstrate strong communication skills (Çuhadar et al., 2014; Dilber & Akhan, 2019), which may help to explain why future anxiety exerts a comparatively limited influence on this dimension. At the sub-dimension level, it is also unsurprising that future anxiety was more strongly associated with economic-social-centred anxiety and appointment-centred anxiety, as these dimensions reflect concerns directly related to sustaining everyday life and gaining entry into the profession. Moreover, the fact that future anxiety significantly predicted dimensions such as task-centred anxiety, personal development-centred anxiety, school management-centred anxiety, and peer and parent-centred anxiety suggests that teacher candidates' anxiety is not solely an employment-related issue, but is also intertwined with expectations regarding relationship management and professional performance. In particular, the more pronounced predictive role of hopelessness about the future for adjustment-centred anxiety may indicate that, during the post-graduation transition, reductions in self-efficacy and perceived control over the future can lead anxiety to cluster around adaptation and settling into the professional role.

A growing body of evidence indicates that future anxiety is associated with multiple aspects of psychological functioning. Bayram and Pala (2025) reported that higher future anxiety was linked to lower psychological well-being, with occupational stress operating as a mediating variable and psychological resilience functioning as a moderating factor. Similarly, Gülbahar, Kuzu, and Sıvacı (2023) found positive associations between teacher candidates' attitudes towards the profession, life satisfaction, anticipated teacher selves, and emotional states, suggesting that expectations and concerns about future professional roles are closely connected to overall well-being. Gerçek (2018) further reported that occupational anxiety across several dimensions—including task-centred, economic-social-centred, student communication-centred, peer and parent-centred, personal development-centred, appointment-centred, adjustment-centred, and curriculum-centred anxiety—was negatively associated with career adaptability. Collectively, these findings suggest that elevated occupational anxiety may diminish teacher candidates' confidence in their capacity to cope with future challenges, adapt to change, and progress in their careers.

In line with the findings, future anxiety—both at the total-score level and at the subscale level—was associated with all dimensions of occupational anxiety and significantly predicted each dimension. This suggests that teacher candidates' future-oriented anxieties may be an influential factor shaping their professional outlook.

Despite its contributions, the present study has several limitations. First, it was limited to future anxiety and occupational anxiety and employed a cross-sectional design, which precludes causal inference. Second, the sample comprised preschool teacher candidates from a single university,

which may restrict the generalisability of the findings. In addition, reflecting the gender distribution typical of preschool education programmes, female candidates were overrepresented in the sample.

Based on the study's findings and limitations, several recommendations can be proposed. Teacher education programmes should be reviewed in light of the observed associations and predictive relationships between future anxiety and occupational anxiety. In line with Öztekin's (2025) recommendations, universities are encouraged to implement interventions to enhance students' well-being, optimism, positive future orientation, and individual strengths. The findings also suggest that teacher candidates may benefit from structured support mechanisms to manage uncertainty related to post-graduation employment. Accordingly, universities could offer regular informational seminars, career guidance activities, and stress-management workshops in collaboration with psychological counselling units and career centres. In this respect, recommendations should not be limited to general workshops; rather, it may be beneficial to implement structured mentoring supports that specifically target the transition into the profession following graduation. In addition, meta-analytic evidence on programmes designed to reduce teachers' stress and psychological strain indicates that brief psychological skills interventions adapted for teacher candidates (e.g., mindfulness-based approaches) can be justified (Klingbeil & Renshaw, 2018). Future research could employ qualitative, mixed-method, longitudinal, or experimental designs to further examine the relationship between future anxiety, occupational anxiety, and other psychological variables such as resilience, depression, and well-being. For example, resilience-focused intervention programmes could be developed and evaluated for their effects on future anxiety, optimism, and psychological well-being. Qualitative studies may also provide deeper insight into teacher candidates' lived experiences and perceptions. Finally, multi-site studies involving candidates from multiple universities, as well as comparative analyses by gender or institutional context, may contribute to a more comprehensive understanding of these issues.

5. Declarations

5.1. Author Contributions (CRediT)

Author 1 (Hülya Gülay Ogelman) Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization; Validation; Project administration.

Author 2 (İlkay Göktaş) Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization; Validation; Project administration.

5.2. Conflict of Interest

The authors declare that they have no known competing financial interests, institutional affiliations, or personal relationships that could have appeared to influence the work reported in this paper. If any potential conflicts exist, they are disclosed as follows: None

5.3. Funding Statement

This research received no external funding. The authors declare that no funding source had a role in the study design; data collection, analysis, or interpretation; manuscript preparation; or the decision to publish the results.

5.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

5.5. Ethics Approval

This study was conducted with the approval of the Ethics Committee for Social and Human Sciences at Ondokuz Mayıs University (Approval No: 2023-684; Approval Date: 28.07.2023). Informed consent was obtained from all participants prior to their participation in the study. Participants were informed about the study's purpose, the confidentiality of their data, and their right to withdraw at any time without penalty.

5.6. Use of Artificial Intelligence (AI) Tools

AI tools were not used to generate or alter empirical data, produce analytical results, or shape the study's core findings and conclusions.

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The role of prototype memories in social studies teachers' instructional decision-making processes: An ethnomethodological analysis

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ABSTRACT

Instructional decisions are the judgments teachers make throughout the instructional process about what, how, why, and when to teach. Examining the various dimensions of how teachers structure these decisions can provide valuable insights into the dynamics of the teaching–learning process. This study aimed to explore how social studies teachers' prototype memories influence their instructional decision-making processes. The research was conducted using an ethnomethodological design grounded in qualitative research methods. The study group consisted of nine social studies teachers working in the province of Nevşehir, selected through convenience sampling. Data were collected using a semi-structured interview form developed by the researchers and analyzed through thematic analysis. The findings reveal that teachers employ prototype memories to guide lesson flow, facilitate classroom management, foster emotional connections with students, and concretize abstract concepts. Teachers perceived these memories as tools for guiding professional identity development and instructional decision-making. However, the study also highlights that prototype memories do not yield uniform effects across all situations. Teachers emphasized considerations such as relevance to the subject, ethical and cultural appropriateness, and timing when utilizing prototype memories in the classroom. Based on these results, teacher education programs should provide learning environments where teacher candidates can share their experiences and develop teaching strategies. Furthermore, the influence of prototype memories on instructional decision-making across disciplines and with larger sample sizes should be investigated in future research.

KEYWORDS: Teacher education; Teaching strategy; Qualitative research; Thematic analysis

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1. Introduction

People's immediate experiences may be influenced by past events. Personal and social experiences play a crucial role in forming individual preferences (Schubert et al., 2019). People often make improvised decisions based on past experiences (Holland, 1999). Such spontaneous decisions can influence many aspects of life, including the educational system. Through this improvisational relationship, teachers may assume responsibility for their instructional decisions despite environmental pressures and constraints such as centralized examinations or parental expectations. Rather than focusing solely on knowledge transmission and exam-oriented instruction, teachers may choose to share their experiences with students using a constructivist approach (Dewey, 2007;

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McLaughlin & Talbert, 2001; Parrott et al., 2000). Although teachers' classroom decisions are often examined through the lenses of curriculum, student characteristics, or teaching methods, their individual experiences play a significant role in shaping instructional decision-making processes. Among these experiences, certain memories that occupy a special place in the lives of teachers, carry strong emotional weight, are frequently recalled, and guide their behavior, are closely associated with instructional decisions (Clandinin & Connelly, 2000).

Instructional decisions encompass judgments about what, how, why, and when to teach during the educational process. These decisions emerge during the planning, implementation, and evaluation stages of instruction (Sancar & Deryakulu, 2020). A range of factors can influence these decisions, including teachers' knowledge, skills, values, experiences, and personal characteristics (Freeman, 1989; Smagorinsky et al., 2003; Spillane, 2002; Stein et al., 1999), as well as their cultural backgrounds (Lim, 2004; Parrott et al., 2000; Rousseau & Tate, 2003) and unique personal memories (Frost, 2009). Schultz (2003) describes such memories as "prototype memories," emphasizing their impact on decision-making. Prototype memories are distinctive recollections shaped by critical turning points, life-changing events, or deeply influential experiences that play a key role in identity construction processes (Schultz, 2003).

This study's theoretical framework adopts the concept of "prototype memories," which draws on Schultz's (2003) notion of the "prototypical scene." In our study, however, the term "prototype memories" was preferred over "prototypical scene," as it better reflects the cultural and linguistic context of Türkiye. While "scene" suggests a visual or immediate experience, "memory" conveys a deeper sense of emotional meaning etched into the minds of individuals. Thus, "memory" more accurately captures teachers' narratives and how they inform instructional decision-making. In Turkish, the word "memory" is translated in a way that more appropriately conveys individual significance-imbued experiences. According to the Turkish Language Association (TLA, 2024), "anı" (memory) refers to the mental traces of past events. A linguist's opinion was consulted to ensure accuracy in conceptual translation and terminology, and the expression "prototype memory" was determined to be more suitable for the theoretical framework of this study. While other scholars (e.g., Chase, 2005; Florio-Ruane, 2001) have emphasized the role of particular stories within narratives, Schultz's (2003, p. 173) description of these stories as "prototypes" underscores how they function as models that shape storytellers' perspectives by "bringing together networks of meaning into concise content." Prototype memories, as narrative elements, can serve as powerful pedagogical tools to help students effectively grasp complex topics (Schultz, 2003).

From this perspective, prototype memories, which are deeply rooted in teachers' past experiences, can directly influence what content is taught, how lessons unfold, how teachers respond to classroom dynamics, and how they engage with students. The literature includes several studies on instructional decision-making (e.g., Coşkun et al., 2020; Frost, 2009; Jenkins, 2018; Kirman Bilgin & Akbulut, 2023; Köylü & Gündüz, 2019; Sancar & Deryakulu, 2020). For example, Coşkun et al. (2020) demonstrated that instructional decisions encompass not only pedagogical but also ethical dimensions. Sancar and Deryakulu (2020) argued that every instructional decision made by teacher candidates in the classroom can be considered a fundamental teaching skill (Shavelson, 1973). Jenkins (2018) found that teachers' professional development positively influences instructional decision-making. Similarly, Köylü and Gündüz (2019) identified a significant relationship between teachers' participation in decision-making processes and their organizational commitment. Collectively, these studies highlight instructional decision-making as a critical teaching skill that directly impacts teaching, learning, and professional engagement.

Despite this extensive body of research, only one study has examined the relationship between prototype memories and instructional decision-making. Frost (2009) explored how prototype memories influenced mathematics teachers' decisions, finding that decision-making was shaped not only by technical knowledge or external constraints but also by powerful personal recollections. Importantly, Frost's (2009) work issued a call to more closely investigate these internal resources. Responding to this call, the present study investigates the role of prototype memories embedded in the experiences of social studies teachers. Furthermore, our research answers Sancar and Deryakulu's (2020) appeal to examine the diverse ways in which teachers construct their instructional decisions, thereby extending the existing literature on prototype memories and decision-making. Given the central importance of instructional decision-making in teacher education (Darling-Hammond & Bransford, 2005; Parsons et al., 2018), this study's findings are expected to provide meaningful contributions for teacher educators, practitioners, and policymakers.

In particular, this study reveals how the narrative-based and socially oriented nature of social studies education—which emphasizes values, lived experiences, and the interpretation of current events—shaped the instructional decisions of teachers through their personal histories. Social studies, by its very nature, serves as a bridge between the past and the present, aiming to foster the sense of identity, belonging, and citizenship of students (National Council for the Social Studies, 2023). Therefore, the prototype memories of teachers, which are rooted in their own life experiences, function not only as personal recollections but also as pedagogical resources that influence what and how they teach (Reed, 2019). When teachers share narratives drawn from these memories (whether related to historical events, social issues, or moral dilemmas) they enable students to engage with content cognitively and affectively, fostering deeper and more meaningful learning experiences. From this perspective, the study identifies a reciprocal relationship between the narrative structure of social studies and personal memory-based experiences of teachers (Reed, 2019). Prototype memories allow teachers to reinterpret their past experiences and integrate them into present instructional contexts (Frost, 2009). The socially and temporally dynamic nature of social studies gives these memories renewed pedagogical meaning. Accordingly, this research demonstrates that social studies teachers ground their instructional decisions not only in pedagogical knowledge but also in their personal narratives intertwined with collective memory and social context.

As the first study to explore prototype memories within the field of social studies education, this study highlights the cultural, emotional, and experiential dimensions of instructional decision-making and opens new directions for understanding teachers' narrative-based pedagogical approaches. Conducted within an ethnomethodological framework, this study contributes uniquely to Turkish educational research by foregrounding the meaning-making aspect of teaching social studies. Furthermore, the findings align with Article 668 of the 12th Development Plan issued by the Presidency of Strategy and Budget of Türkiye (2024), which emphasizes enhancing the teaching profession's quality. In this regard, this study aims to uncover how prototype memories shape instructional decisions of social studies teachers and how these memories function within narrative-driven teaching, values education, and the cultivation of social awareness. The following research question was addressed: What is the role of prototype memories in the instructional decisions of social studies teachers?

2. Method

This section provides information on the research method, design, data collection, and analysis.

2.1. Design

The study employed an ethnomethodological design and a qualitative research approach. Ethnomethodology examines the methods individuals use in their daily lives to construct social order and meaning. In contrast to traditional sociological theories, it posits that social order is continuously produced through individual interactions rather than externally imposed (Garfinkel, 2014, p. 79). The central focus of ethnomethodology is to explore how individuals create, structure, and assign meaning to social reality in everyday contexts (Coulon, 2015). Within this design, the researcher adopts the role of an analyst seeking to understand participants' meaning-making processes from within their lived experiences (Garfinkel, 2014). Ethnomethodology provides a valuable framework for analyzing teachers' classroom decision-making processes and their communication with students (Sancar & Deryakulu, 2020). It also reveals how participants' cultural backgrounds (social reality) are reflected in their daily interactions within educational settings (Garfinkel, 2014).

2.2. Participants and Procedure

A convenience sampling technique was employed to ensure efficient and cost-effective qualitative data collection (Merriam, 2009). This method offers advantages such as rapid access to participants and reduced costs, as it enables researchers to work with readily available individuals (Patton, 2002). The study group comprised nine social studies teachers working in the Nevşehir province who were accessible to the researcher. Table 1 summarizes the demographic characteristics of the participants.

Table 1 ***Demographic characteristics of the participants***

Feature	Categories	n
Experience	6–10 years	2
	11–15 years	2
	15 years and above	5
Gender	Male	5
	Female	4
Undergraduate Graduation	Social Studies	5
	History	2
	Geography	2

Table 1 shows that five participants were male and four were female. Their professional experience ranged from 8 to 28 years. Regarding their undergraduate education, two participants held degrees in history, two in geography, and five in social studies.

2.3. Data Collection Tool

Data were collected through a semi-structured interview form developed by the researchers. Semi-structured interviews are a widely used technique in qualitative research because they combine pre-prepared questions with the flexibility to elicit new, context-specific questions based on participants' narratives (Merriam, 2009). This flexibility, which is particularly valuable in ethnomethodological studies, facilitates the collection of personal and narrative data and enables participants to articulate their own experiences (Garfinkel, 2014). The opinions of two experts in qualitative research methods

and social studies were sought to ensure the validity and reliability of the semi-structured interview form. Based on their feedback, the questions were reviewed and revised accordingly. Some questions were removed from the questionnaire; some were simplified to improve understandability. Furthermore, a pilot study was conducted with three teachers to test the clarity of the questions, after which the interview form was finalized (Yıldırım & Şimşek, 2013).

2.4. Data Collection

Interviews were conducted individually with teachers in their natural settings (schools) and lasted approximately 30 minutes (Garfinkel, 2014; Merriam, 2009). The researchers collected data through audio recording. Data collection was concluded after the ninth interview, as no new themes emerged, responses became repetitive, and existing categories reached saturation (Guest et al., 2006; Morse, 1995).

2.5. Data Analysis

The collected data were analyzed using thematic analysis. Thematic analysis enables researchers to generate meaningful themes from qualitative data and systematically interpret their content (Liamputtong, 2009). Thematic analysis is a fundamental qualitative technique that can be applied flexibly across different epistemological approaches and research questions (Braun & Clarke, 2006). In this study, data were analyzed following Braun and Clarke's (2006) six-phase thematic analysis model. In the first phase, interview transcripts were produced, allowing the researcher to carefully review and interpret all statements and develop a general understanding. In the second phase, the participants' responses were examined, and statements with similar content were grouped into codes. Important points were identified and organized into themes in the third phase based on semantic similarities. During the fourth phase, the emerging themes were re-examined against the data, and elements lacking semantic coherence were either eliminated or revised. In the fifth phase, sub-themes were created where appropriate, and themes were subsequently renamed to better reflect their meanings and clearly delineate their scope. In the final phase, a table was prepared to clearly present the themes, with explanations for each theme and illustrative quotations from participants' statements. Direct quotations were incorporated throughout the analysis to enhance reliability and maintain data fidelity. Such quotations not only supported the development of themes but also strengthened the construction of meaning. As Merriam (2009) noted, the use of direct statements by participants is a key factor in increasing descriptive validity and credibility in qualitative research. Similarly, Patton (2002) and Yıldırım and Şimşek (2013) highlighted that incorporating direct quotations enriches both the depth and rigor of qualitative studies.

2.6. Validity, Reliability, and Ethical Considerations

Before starting data collection, ethical approval was obtained from the Nevşehir Hacı Bektaş Veli University Scientific Research and Publication Ethics Committee. Participation in the study was voluntary. Participants were informed about the research purpose, procedures, and confidentiality principles, and written consent was obtained. Video recordings were used to support the contextual interpretation of teachers' emotions and thoughts in line with the ethnomethodological approach (Garfinkel, 2014). However, as five teachers did not consent to video recording, data from these participants were collected through audio recordings or written notes in accordance with ethical principles. All interviews were conducted confidentially, with teachers assigned codes (e.g., T1, T2, and T3), and no identifying information was disclosed.

To enhance reliability, researcher triangulation was employed. In scientific research, triangulation refers to approaching a phenomenon from multiple perspectives to increase accuracy (Neuman,

1991). Researcher triangulation specifically involves the participation of more than one researcher in the data collection or analysis processes (Bhandari, 2023). In this study, diversity was ensured by collecting data from different schools. The research team first analyzed the data independently and then consolidated their findings for a holistic evaluation. In addition, an academician specializing in qualitative research reviewed the coding and theme development process, and consensus was reached to strengthen the consistency of interpretations.

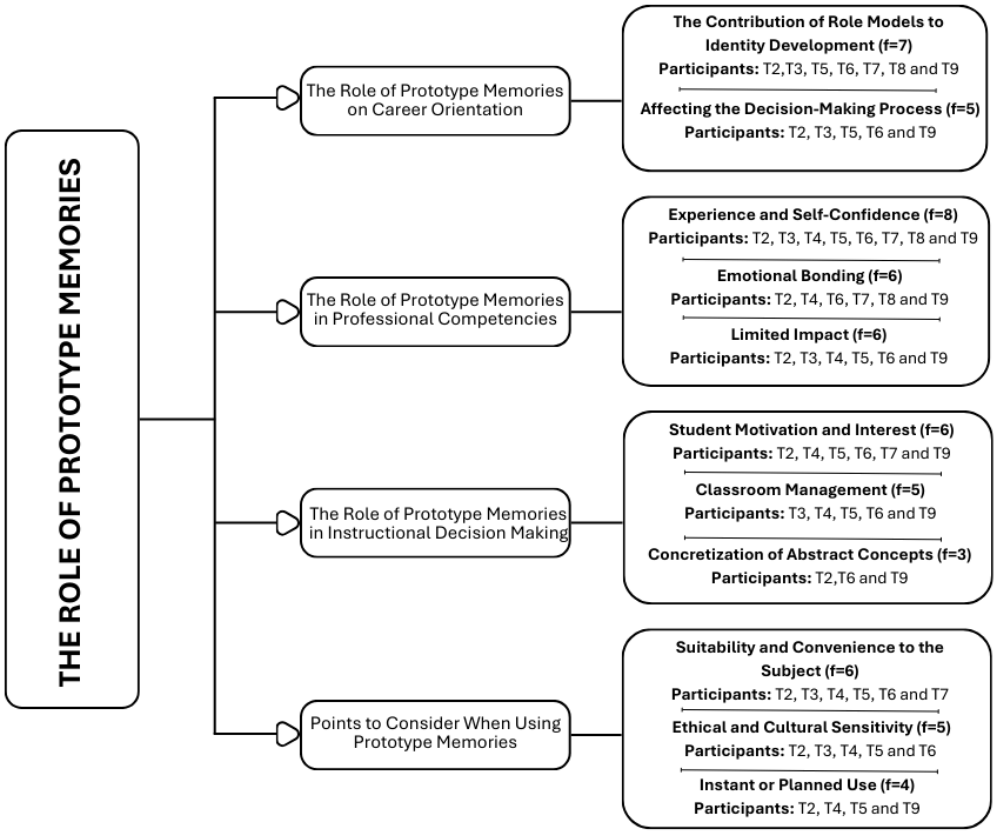
3. Findings

Following the data analysis, the participants' opinions were grouped into four main themes. The research findings are presented below, organized by the following themes. Table 2 presents an overview of the themes, sub-themes, and frequencies identified in the study.

Table 2 ***Overview of themes, sub-themes, and frequencies***

Theme	Sub-theme	f	Participants
Role of Prototype Memories in Career Orientation	Role Models' Contribution to Identity Development	7	T3, T7
	Influencing the Career Decision-Making Process	5	T5, T6
Role of Prototype Memories in Professional Competencies	Experience and Self-Confidence	8	T2, T8, T9
	Establishing Emotional Connections	6	T6
	Limited Impact	6	T3, T6
Role of Prototype Memories in Instructional Decision-Making	Student Motivation and Interest	6	T2
	Classroom Management	5	T3
	Concretizing Intangible Concepts	3	T6
Points to Consider When Using Prototype Memories	Adaptability and Suitability of the Subject	6	T4, T8
	Ethical and Cultural Sensitivity	5	T4, T6
	Instant or Planned Use	4	T2, T5

Figure 1 *Role of prototype memories in instructional decision-making processes*



3.1. The Role of Prototype Memories in Career Orientation

The findings indicate that teachers' orientation toward the profession is not arbitrary but closely tied to prototype memories from their past and the formative influence of these experiences. The role models encountered during participants' early interest in teaching left lasting impressions on their professional trajectories. Moreover, prototype memories acquired during their own learning experiences significantly contributed to the development and shaping of their teaching perspectives. The data reveal that such memories play a decisive role in both the formation of teachers' identities (f = 7) and their professional decision-making processes (f = 5).

3.1.1. Role Models' Contribution to Identity Development

Many participants stated that the prototype memories they encountered during their teacher education served as role models, shaping their current teaching roles. Participant T3 reflected as follows:

> "My primary school teacher had a profound impact on me. The demeanor of my philosophy teacher, his command of the lessons, and his communication with students left a strong impression on me. I sometimes adopt a different stance because of him. My primary school teacher's ability to engage with students' inner worlds and to treat boys and girls equally, fairly deeply influenced me. I attended primary school in Diyarbakır. From my teacher, I learned how to dance, how not to smack my lips, and how to properly eat. These lessons left a lasting impression on me." (T3)

Similarly, participant T7 highlighted the influence of professors during university:

> "During my university years, I was very impressed by some professors' classroom practices. My professor's effective use of body language, particularly in the introductory course, left a positive impression on me. This experience encouraged me to use body language more effectively in my professional life. His skillful use of body language not only motivated us but also enhanced our engagement as students." (T7)

As these narratives suggest, prototype memories and the teacher figures that participants regarded as role models played a strong role in shaping their teaching identities.

3.1.2. Influencing the Career Decision-Making Process

The findings indicate that prototype memories played an influential role in participants' career decision-making. Participant T5 emphasized the importance of these memories in shaping her career path:

> "My teacher, Tufan Gündüz, was the biggest reason I chose this department and teaching as a profession. His teaching style was very different. He made me love history, and my dream of following in his footsteps came true." (T5)

Similarly, T6 described the lasting influence of a middle school teacher as follows:

> "...There was something I paid particular attention to after I started teaching. I had a favorite teacher in middle school, and I took her as a role model without even realizing it. If N*A* is alive, she may live long. Sometimes, when I am teaching, I feel as though she is the one teaching. I absorbed her deeply. She was a very sweet teacher. She would chat with our families and sit at our table. These were beautiful experiences. She touched my heart and left a mark on my soul. I feel as if I am in her shoes." (T6)

These accounts clearly demonstrate that prototype memories significantly influenced teachers' career choices. In particular, role models were frequently cited as pivotal in participants' decisions to pursue teaching.

3.2. Role of Prototype Memories in Professional Competencies

Another key finding of the study is that teachers' prototype memories from past experiences shape their professional competencies. Participants reported that such memories not only enhanced their self-confidence in the teaching process but also supported more effective communication with students. At the same time, some participants noted that these memories were not always decisive and that their influence could be limited. Among the themes identified in participants' prototype memories, experience and self-confidence (f = 8) were the most frequently emphasized elements, followed by emotional connection (f = 6) and limited spheres of influence (f = 6).

3.2.1. Experience and Self-Confidence

Teachers reported that prototype memories gave them courage during instructional decision-making and served as references. Participant T2 explained:

> "Past events contain experience... Based on these experiences, we can produce solutions to similar situations." (T2)

Similarly, T9 emphasized the connection between prototype memories and teaching experience:

> "I think what we call a prototype memory is something that comes with experience in teaching. I agree with this sentiment... As you can see from the examples I've given, experience will show you how to continue on your journey." (T9)

Participant T8 also reflected on how extensive teaching practice contributed to building self-confidence:

> "...Our professors, especially in recent years, made us teach too many lessons. At first, it seemed very boring and difficult, but I think these lessons helped me gain self-confidence." (T8)

Taken together, these narratives illustrate that prototype memories are not merely recollections of the past but serve as critical foundations for developing professional competence. They provide teachers with strategies to address challenges and reinforce their self-confidence, which, in turn, is reflected in their decision-making.

3.2.2. Establishing Emotional Connections

Another sub-theme that emerged from the data analysis is emotional connection. This theme illustrates how teachers use prototype memories to build emotional bridges with their students. Sharing such memories not only allows students to see their teachers as more than lecturers but also helps them focus and fully engage in the learning process. Participant T6 emphasized this point:

> "...A lesson can be taught without memories, but when you include them, you create a different connection with the student. The student does not see you as just a lecturer. They get to know you and realize that you have a life. This creates a close and trusting relationship between the student and me. We connect with students not only technically but also emotionally..." (T6)

Based on these findings, the memories teachers share in their classrooms contribute significantly to building trust and fostering stronger teacher–student relationships.

3.2.3. Limited Impact

The findings also indicate that teachers' prototype memories are not always effective and do not have the same influence on every teacher. Participant T3 reflected as follows:

> "...It is partially effective; it does not have the same effect on everyone. We cannot share every memory, nor can we bring it up without reason. It should be shared at an appropriate time. Negative experiences should not be discussed, and some memories are not suitable to share with students..." (T3)

Similarly, participant T6 remarked:

> "...Is it essential? No, of course not. A lesson can certainly be taught without memories. However, when we add our memories to the lesson, we connect with the students a little more. It can create an emotional impact..." (T6)

These accounts indicate that prototype memories do not always yield the same level of influence. Therefore, their impact may be limited in classroom contexts. The findings highlight the importance of teachers being selective when sharing prototype memories and carefully considering factors such as relevance and students' levels of interest.

3.3. The Role of Prototype Memories in Instructional Decision-Making

Another key finding of the study is that participants' past experiences, which left a lasting impression, significantly influenced their instructional decisions. Teachers reported drawing most frequently on prototype memories to enhance student motivation and engagement (f = 6), support classroom management (f = 5), and concretize abstract concepts (f = 3). These results underscore teachers' tendency to rely on past experiences as valuable resources for guiding their instructional practices.

3.3.1. Student Motivation and Interest

The most salient finding regarding the role of prototype memories in instructional decision-making concerns students' motivation and engagement. The data show that teachers deliberately use

prototype memories to capture students' attention and enhance their motivation. Participant T2 explained:

> "When the child's attention is distracted, if you tell a story, they all listen with great attention... The pencils stop, the conversation stops... their attention is on you." (T2)

This account illustrates that prototype memories are effective at sustaining students' attention and fostering engagement in the classroom.

3.3.2. Classroom Management

Classroom management was another sub-theme that emerged from the data analysis. Teachers reported that recalling how they had previously addressed challenges enabled them to act more consciously in similar situations. Participant T3 recounted advice received from an experienced colleague early in her teaching career, which she considered a prototype memory:

> "I was struggling to control the class. An experienced colleague said, 'Give one student a task in the class and just supervise them.' That was one way to manage the class." (T3)

This finding illustrates that teachers use prototype memories as guiding tools, using past experiences to inform their instructional strategies, particularly in directing lessons and maintaining classroom order.

3.3.3. Concretizing Intangible Concepts

According to the findings, teachers employ prototype memories to make abstract concepts more accessible to students and adapt instruction to their level of understanding. Participant T6 explained:

> "While explaining the subject of democracy, I gave them an example and told them a story I had experienced so that they could understand the difference between the two. I said that the form of government is actually a republic, but the way of life is democracy." (T6)

T6 further elaborated with a classroom example:

> "Just yesterday, I was teaching a 7th-grade class on democracy. I began with a story from my own life. The students really enjoyed it. I started by saying, 'My little boy.' They all listened intently. When I told them that he was 21, they laughed heartily. They asked, 'Is your little boy 21?' I recalled a memory from when my son was in kindergarten. For a performance, the children were supposed to bring cakes and juice. My son wanted a moloch cake and peach juice. By the time I arrived after my class, the cakes had already been distributed. Despite being a child with a strong appetite, he had not eaten anything and was waiting sadly. I asked him why, because this was unusual for him. He explained that the teacher had not asked for his preference and simply handed out other treats. I exaggerated the story to capture the students' attention, but the point was clear: individual preferences matter and should be respected in a democratic environment." (T6)

T6 concluded: "Children get bored in class. Imagine making them sit at a desk for 40 minutes. The more we connect them to real life, the more engaged they become, and the lesson leaves a lasting impression."

These findings demonstrate that prototype memories are particularly effective in making abstract concepts more concrete and relatable. Teachers transform difficult-to-grasp ideas into meaningful narratives that facilitate comprehension and enhance learning by drawing on their own lived experiences.

3.4. Points to Consider When Using Prototype Memories

The findings indicate that when incorporating prototype memories into classroom instruction, teachers must attend to specific criteria. These considerations reflect the importance of prototype memories and the manner in which they are conveyed. The data show that teachers placed particular emphasis on relevance to the subject (f = 6), ethical and cultural sensitivity (f = 5), and whether the use of memories was planned or spontaneous (f = 4).

3.4.1. Adaptability and Suitability of the Subject

The most critical consideration in using prototype memories is their relevance and suitability to the subject matter. The participants emphasized that not every memory is appropriate for the classroom context and that sharing such experiences requires careful judgment. Participant T4 noted:

> "...If a prototype memory that has no connection with the subject or the event in the lesson is chosen and told, it will result in nothing but a waste of time. If a memory relevant to the topic comes to the teacher's mind and is used at that moment, it will be more effective for the student." (T4)

Similarly, participant T8 explained:

> "...It can be effective if you tell students about things they have experienced. In general, everything can serve as an example. It's not only a memory you've personally experienced; it's even an example from daily life. It is even more important to draw students' attention to something they might have heard or seen. It is effective in education and enriches the subject you are discussing." (T8)

This finding illustrates that teachers not only draw on their experiences but also develop pedagogical sensitivity to determine when and how to convey them.

3.4.2. Ethical and Cultural Sensitivity

The findings indicate that participants demonstrated ethical and cultural sensitivity when sharing their prototype memories. Participant T4 remarked:

> "Using prototype memories would be a good approach. It would be more effective if they were told without mentioning the name of the school or the workplace." (T4)

Similarly, T6 emphasized the importance of appropriateness:

> "...Of course, as I just said, that link needs to be adjusted very carefully. You should not get too personal, use inappropriate language, or tell offensive stories. Everything should be completely suitable for the level and age of the students." (T6)

These perspectives reveal that sharing prototype memories in the classroom requires a clear ethical framework and cultural sensitivity. Teachers stressed the importance of ensuring that the content of their memories was age-appropriate and respectful of privacy.

3.4.3. Instant or Planned Use

In this sub-theme, participants reported that their use of prototype memories most often occurred spontaneously during instruction, although previously prepared memories were also employed in some cases. Participant T2 explained:

> "Let me give you an example from myself. Most of them are spontaneous because the class was very messy that day, and you need to tell this memory. Sometimes, while teaching a particular topic, I decide to share a memory with the class." (T2)

Similarly, T5 emphasized the role of context in determining when to use memories:

> "...I determine the topics according to the events and the subject of the course. The subjects and events we experience are the primary determining factors. It would be very beneficial if we could learn from both positive and negative experiences in real life." (T5)

These accounts demonstrate that prototype memories are used either spontaneously, emerging naturally in the lesson's flow, or as pre-conceived narratives prepared in advance. In both cases, teachers draw on personal experiences as pedagogical tools to concretize abstract content, capture students' attention, and deepen meaning in the classroom.

4. Discussion

This study aimed to examine the role of prototype memories in the instructional decision-making processes of social studies teachers. The first main result revealed that prototype memories play a significant role in shaping teachers' orientation toward the profession and their understanding of teaching. Role model teachers were found to be particularly influential in shaping individuals' interest in teaching, a finding consistent with Bandura's (1986) social cognitive theory, which emphasizes observational learning. Similarly, Lortie (1975) argued that teachers' prospective encounters during their educational journeys strongly shape their career orientation. Beijaard et al. (2004) also highlighted that past experiences, role models, and professional interactions nurture the formation of teacher identity. According to Bruner (1990) and McAdams et al. (1997), narratives and life stories provide insight into how individuals make sense of themselves and their lives. This narrative approach has become increasingly common within teacher education research (Casey, 1993). The stories teachers live and tell serve as a lens through which they interpret both their personal and professional selves and the content and context of their work, including instructional innovations.

The prototype memories of teachers are informed not only by individual experiences but also by teacher education programs, professional development activities, and collaborative collegial settings (Smagorinsky et al., 2003; Stein et al., 1999). In the context of Türkiye, studies suggest that social ties exert a stronger influence than individual preferences on career choice (Koçakoğlu & Yalçın, 2020), and a collectivist culture amplifies the impact of role models (Hofstede, 2001; Kağıtçıbaşı, 2017). This underscores the significance of prototype memories as a source of motivation in the career decision-making processes of social studies teachers.

Another important result is that prototype memories contribute to the development of professional experience and self-confidence among teachers. Berliner (1994) emphasized the complex knowledge structures of expert teachers, while Ertmer and Stepich (1999) noted that knowledge-based experiences fundamentally nourish instructional decisions. Parsons et al. (2018) similarly argued that teachers' pedagogical competence is grounded in prior experiences and structured knowledge bases. Research further suggests that expert teachers rely on this accumulated knowledge to inform decisions across a range of learning and teaching situations, whereas novice teachers often draw upon limited and superficial information (Demiraslan Çevik, 2013). Consistent with these results, Eisner (1988) contended that teacher education should move beyond conventional and technocratic approaches to embrace the affective dimensions of teaching, including intuition, creativity, and compassion. The narrative inquiry tradition (Connelly & Clandinin, 1988; Elbaz, 1991) also underscores the critical role of teachers' personal experiences and intuitive wisdom in shaping instructional decisions.

A further result is that prototype memories directly influence instructional decision-making. Teachers used such memories to concretize abstract concepts, enhance student motivation, and support classroom management. This indicates that teachers rely not only on technical knowledge but also

on narratives and stories from their own experiences. Frost (2009) highlighted that teachers' stories are a vital tool for explaining instructional decisions and clarifying course content. Similarly, Bolkan et al. (2019) argued that narratives enhance student learning by engaging them through metaphors and imagery, rather than relying solely on analytical reasoning. This dual-processing approach activates both rational and experiential systems, making the learning of complex and abstract concepts more effective. Furthermore, research suggests that cultural backgrounds also influence instructional decisions, as teachers adapt their stories and narratives with sensitivity to students' cultural contexts (Lim, 2004; Parrott et al., 2000; Rousseau & Tate, 2003). Within this framework, Ryan and Deci (2000) noted that teachers can foster student success by safeguarding basic psychological needs, such as autonomy and competence, through the narratives they share. Balli (2010) demonstrated that the episodic, memory-based experiences of prospective teachers were directly reflected in their classroom management practices. Collectively, these results confirm that instructional decision-making relies not only on theoretical knowledge but also on the internal resources of past experience.

The study also showed that the use of prototype memories requires careful consideration of relevance, ethical and cultural sensitivity, and timing. Existing literature on traditional narratives and storytelling provides limited guidance on what stories are appropriate to tell, to whom, and under what circumstances. This gap highlights the importance of teachers' ability to evaluate timing, topical relevance, and audience characteristics when sharing prototype memories. Teachers must carefully select stories not only in terms of content but also in terms of context and timing (Şimşek, 2004). Such attentiveness enhances narratives' pedagogical value while safeguarding ethical and cultural considerations. In particular, timing plays a crucial role in instructional decision-making. The significance of the temporal dimension of discourse in the development of knowledge and understanding has been well documented (Alexander, 2000; Crook, 1999; Cobb, 1999; Erickson, 1996; Lemke, 2001; Nystrand et al., 2003; Roth, 2001). Teachers can integrate prototype memories either spontaneously in response to immediate situations or deliberately through advanced planning. Both approaches require attention to timing and content relevance to maximize instructional effectiveness (Roth, 2001).

Finally, the increasing diversity of today's classrooms—characterized by students from varied ethnic, cultural, and linguistic backgrounds—further underscores the need for ethical and cultural sensitivity in instructional practices (Serdyukov, 2017). In Türkiye, internal and external migration, social transformations, and urbanization have contributed to the growing demographic diversity in schools (Bölükbaşı, 2024). Such diversity necessitates that teachers consider students' cultural characteristics, values, and sensitivities when incorporating prototype memories into instruction. Similarly, Gay (2015) argued that traditional classroom management strategies are insufficient in diverse learning environments and that teachers must adopt more inclusive and culturally responsive approaches. In summary, the effective use of prototype memories requires teachers to consider classroom demographics, cultural diversity, ethical sensitivities, and timing. Attention to these elements contributes to creating an inclusive and equitable learning environment while simultaneously fostering students' sense of value and encouraging their active participation in the learning process.

5. Limitations and Future Directions

Based on the results of this study, several recommendations can be made to inform teacher education practices and guide future research. When teachers interpret situations encountered during instruction, awareness of prototype memories from their past experiences may enable them

to make more informed decisions. Therefore, teacher education programs should encourage candidates to recognize and reflect on their meaningful past experiences. Reflective practices should be incorporated to foster learning and draw pedagogical conclusions from such experiences. During teaching practice courses, candidates should be provided with opportunities to analyze their own learning stories. By systematically evaluating teachers' responses to past challenges, they may be better equipped to make informed decisions in similar situations in the future. To support this, structured learning environments should be designed to critically analyze teacher candidates' experiences. Such processes create a cyclical learning pattern that enhances teachers' professional competence.

This study was limited to social studies teachers in the Nevşehir province. Future research involving teachers from different geographical regions could shed light on how cultural and institutional differences shape prototype memories. In addition, the experiences of teachers across different educational levels, such as primary and secondary schools, should be examined comparatively. The role of prototype memories in instructional decision-making may also vary across subject areas. Therefore, future studies should compare the experiences of teachers working in fields such as science, mathematics, Turkish, and foreign languages. Such research could reveal how interdisciplinary pedagogical cultures influence instructional decision-making.

This study collected data exclusively through semi-structured interviews. Future studies should integrate additional qualitative techniques, such as classroom observations, teacher diaries, and analysis of teaching materials, to provide deeper insights into how and in what contexts teachers use prototype memories. These methods would allow the observation of teachers' behaviors in natural settings rather than being limited to self-reported narratives. Finally, longitudinal research is needed to investigate how novice teachers structure their experiences over time and which prototype memories guide their instructional decisions at different stages of their careers. Such research would provide a more systematic understanding of the place and significance of prototype memories across teachers' professional lifespan.

6. Conclusion

This study examined the role of prototype memories in social studies teachers' instructional decision-making processes. The research was conducted using an ethnomethodological design within a qualitative framework. The study group consisted of nine social studies teachers working in Nevşehir Province, selected through convenience sampling. Data were collected through a semi-structured interview form developed by the researchers and analyzed using thematic analysis. The results revealed that teachers employed prototype memories to guide lesson flow, support classroom management, establish emotional connections with students, and make abstract concepts more tangible. Teachers also viewed these memories as a resource for professional identity development and instructional decision-making strategies. However, the results further indicated that prototype memories do not have the same impact across all situations, highlighting the need for careful consideration when applying them in practice.

Based on these results, teacher education programs should provide learning environments in which teacher candidates can share their experiences and develop teaching strategies grounded in those experiences. Future research should examine the effects of prototype memories on instructional decision-making in different subject areas and across larger, more diverse samples. In conclusion, this study contributes to the growing body of research on instructional decision-making by highlighting the role of prototype memories in social studies education. This study underscores the

importance of narratives and lived experiences in professional practice by demonstrating how teachers draw on their past experiences to manage classrooms, motivate students, foster emotional connections, and clarify abstract concepts. At the same time, the identified limitations—particularly the small sample size and focus on a single region—point to the need for further research across diverse contexts, subject areas, and educational levels. Taken together, the results emphasize that teacher education programs should integrate reflective practices that enable candidates to critically examine their personal experiences, thereby strengthening their professional identity and decision-making skills. This research offers both theoretical insights and practical implications for creating more responsive, culturally sensitive, and experience-based approaches to teacher preparation and professional development.

7. Declarations

7.1. Conflict of Interest

The authors declare that they have no known competing financial interests, institutional affiliations, or personal relationships that could have appeared to influence the work reported in this paper.

7.2. Funding

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7.3. Author Contributions (CRediT)

Muhammed Talha Özalp: Conceptualization; Methodology; Data curation; Formal analysis; Writing-review & editing.

Gülşah Nazlı Oğuz: Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing-original draft; Writing-review & editing.

Eda Dinçer: Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing-original draft; Writing-review & editing.

Emine Büşra Kaya: Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing-original draft; Writing-review & editing.

All authors have read and approved the final version of the manuscript.

7.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

7.5. Ethics Approval

Ethics Committee: Nevşehir Hacı Bektaş Veli University, Scientific Research and Publication Ethics Committee Approval Number: 2025.06.197 Approval Date: 23.05.2025 Informed Consent: Written informed consent was obtained from all participants before the interviews. Participation was voluntary, and confidentiality was ensured.

7.6. Use of Artificial Intelligence (AI) Tools

AI-assisted tools were used for language editing. No AI tools were used to generate empirical data or analytical results.

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Views of Turkish as a foreign/second language learners on grammar

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ABSTRACT

Turkish Language Teaching Application and Research Centers (TÖMER) support basic language skills with grammar lessons. Although practices vary from center to center, in many TÖMERs, grammar lessons are taught as a separate, independent component from skill lessons, and learners are subjected to exams on these subjects. Studies on grammar teaching advocate that grammar should not be prioritized but taught intuitively, and instructors also state in interviews that this approach is correct. However, when we look at the current situation and practices, the situation is different. Grammar lessons take precedence over skill lessons and even become the focus. The views of instructors are generally taken into account; the views of experts are included, but the views of learners of Turkish as a second/foreign language on grammar courses remain in the background. To fill this gap in the literature, interviews were conducted in the current study to determine the views of learners of Turkish as a second/foreign language on grammar courses. A total of 20 advanced-level participants who had learned Turkish as a second language were included in the study. In addition to their demographic information, participants were asked 8 open-ended questions. The open-ended questions were designed to elicit participants' views on grammar and grammar courses. The participants' answers were recorded both in writing and audio recording by the researcher. The data analysis for this study followed an inductive approach focused on category construction. When the participants' answers were examined, it was concluded that learning grammar is essential for proper communication, motivates them to use language productively, and helps them understand the full context of receptive skills. However, when grammar is not learned correctly, it prevents them from speaking and writing, and keeps them unaware while reading and listening.

KEYWORDS: Teaching Turkish as a foreign/second language; grammar; learner's view

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1. Introduction

How much to teach, and how to teach grammar in a foreign language, has always been a matter of debate. Whether grammar should be taught implicitly or directly, and whether it should be taught functionally or as a completely rule-based system, are matters of debate among researchers and instructors. While researchers associate grammar instruction with basic language skills, instructors believe grammar should be treated as a distinct skill. According to researchers, while it is important to view language as a whole, including grammar and skills, instructors argue that addressing skills separately will make education and training more effective (Ekşi et al., 2021, p. 74). For this reason, there are differences between theory and practice in grammar teaching. "Very different perspectives

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have been put forward regarding grammar teaching, such as transferring structures explicitly or implicitly, following the learning order in the mother tongue as much as possible, allowing learners to discover this order on their own without following a certain learning order, and even ignoring grammar." (Güven & Özmen, 2016). In addition to the differing views of researchers and instructors, it is essential to determine learners' views on grammar instruction and take them into account when planning the teaching process. Although learners tend to be more receptive to more formal, traditional grammar instruction and direct error correction, instructors tend to adopt more innovative approaches in this regard (Borg, 2003).

Grammar is often misunderstood in the field of language teaching. Grammar is often thought of as the rules governing constant structures in a language. There is a belief that structures should not be taught, that learners will acquire them on their own, or that, if structures are taught, subsequent lessons will be boring (Zhang, 2009). In mother tongue acquisition, grammar can be acquired on its own without the need for any teaching process. However, this is not possible in the process of learning a foreign or second language, and grammar must definitely be taught. Teaching grammar remains central to language teaching today, and it is widely accepted that it is not possible to completely exclude grammar from the language-teaching process. Ellis (2006), in his study of grammar teaching, states that grammar teaching is important not only for form but also for conveying meaning and different grammatical uses. The focus of grammar teaching should be on problematic structural elements so that learners can understand clearly. The most important period for teaching grammar is the intermediate level, when learners can produce the language. However, giving feedback is important for helping learners learn grammar correctly. Learners should have the opportunity to practice grammar with communicative tasks after learning it through the focus-on-forms approach. The other point is that grammar should be taught using a massed approach rather than a distributed approach. Grammar should be used as both input-based and output-based instructional options. Explicit grammar instruction can bridge the gap to implicit acquisition and fit within both focus-on-form and focus-on-forms approaches. Regarding the latter, a balanced combination of deductive and inductive teaching methods is recommended for optimal results. Unlike the intensive, deep study found in 'focus-on-forms,' an incidental 'focus-on-form' approach is valuable for its ability to address a broad spectrum of grammatical problems as they occur. Corrective feedback is essential for grammatical development. The most effective approach employs a diverse range of strategies, combining implicit and explicit techniques, as well as input- and output-oriented feedback. Consistent with this view, grammar pedagogy should adopt a dual structure: it must include dedicated instruction on specific structures (a 'focus-on-forms' approach) while simultaneously integrating attention to grammar into meaning-focused communicative tasks (a 'focus-on-form' approach).

There are studies in the literature that include instructor and learner views on teaching grammar. Ekşi et al. (2021) applied to both instructor and learner views in their study on teaching grammar in the native language. The study concluded that both instructors and learners found grammar instruction necessary, but textbooks were insufficient in this regard. While there are studies on instructors' views on teaching grammar in foreign language teaching, very few take learners' views into account. The findings of another study that gathered instructors' views revealed that instructors have a positive and constructive attitude toward the importance of teaching grammar and agree that proficiency in the target language is achieved faster with good knowledge of grammar. The instructors who participated in the study stated that immediate correction of grammar errors harms learners' self-confidence levels and negatively affects their motivation (Al-khresheh & Orak, 2021). Male (2011) obtained the

views of foreign language learners on learning grammar and concluded that grammar is generally important for learners in foreign language learning, that grammar plays an important role, especially in writing skills, but that it does not have a significant effect on speaking skills. In the study by Saengboon et al. (2022), the views of both instructors and learners on the role of grammar in the foreign language learning process were addressed. The vast majority of participants in the study said that grammar education was useful for academic reading and reaching the goals in academic exams. Based on the participants' views, it was concluded that grammar plays a fundamental role in developing language proficiency, contrary to the idea that it makes communication difficult and hinders it.

In the field of teaching Turkish as a foreign/second language, which is the subject of the current study, most studies have focused on instructors' views; there are not enough studies on learners' general views, and few have examined skill-based views on grammar. Akbaş (2023) gathered the views of Turkish as a foreign language instructors on functional grammar in her study and, in line with these views, concluded that instructors believed functional grammar should be integrated with language skills, be related to daily life, and be context-based. Yılmaz & Dilidüzgün (2019) studied text-based grammar with learners of Turkish as a foreign language. In the study, which used text-focused grammar teaching activities, learners were asked about their views on learning grammar through texts. Learners said that they found these studies meaningful, useful, fun, and memorable.

In this study, which was prepared to fill the gap in the literature regarding the views of learners of Turkish as a foreign/second language, the following research questions were sought to obtain learners' views on grammar teaching and grammar courses:

1. Do learners spot the grammar in use?
2. How does grammar affect basic Turkish language skills?
3. How does grammar affect their motivation to learn Turkish?
4. What are the learners' views on the formal structure of grammar courses?

2. Method

This research aims to determine and evaluate the views of B2–C1-level learners who learn Turkish as a second language regarding grammar, using a qualitative content analysis model. In the current study, the number of participants was limited to 20, and the views and experiences of those learning Turkish as a second language regarding grammar were examined. Turkish-language preparation school learners are required to take grammar lessons in addition to skill lessons. The institution uses the New Istanbul Turkish for International Students course set, and lessons are planned according to the coursebook. Students receive 4 hours of separate grammar lessons, totaling 20 hours of weekly instruction. For one language level (6 weeks), it means 24 hours of grammar lessons. In the institution's curriculum, not all courses are taught by the same instructor, but by at least two different instructors. Therefore, when examining the findings, it is important to consider that students receive grammar lessons from at least two different instructors, 8 hours a week, with reading-skill lessons and the New İstanbul coursebook. Learners' views were classified accordingly.

The study was approved by the Bartın University Ethics Committee. The data analysis for this study followed an inductive approach focused on category construction, as outlined by Merriam and Tisdell (2016). The primary goal was to make sense of the participants' experiences by identifying recurring patterns within the dialogue.

Analysis began immediately following the first interview to allow for emerging insights to inform subsequent data collection. The transcripts were analyzed using the constant comparative method.

First, the researcher checked the writing records against the audio recordings. Then read through each transcript line-by-line, noting key concepts and significant phrases in the margins. Next, these open codes were grouped together based on similarities to form tentative categories. Through a recursive process of comparing incidents to incidents and incidents to categories, these groupings were refined until a final set of themes emerged that directly answered the research questions (Merriam & Tisdell, 2016).

2.1. Participants

The study included 20 participants at B2 and C1 levels who were learning Turkish as a second language at the same institution. It was ensured that the participants were receiving Turkish-language education at the same institution, starting at A1, and were following the same course book and syllabus. Participants were selected from different countries, but because the study was limited to a single institution, it was not possible to avoid including participants from the same country. Participation by those who met the study's eligibility criteria was entirely voluntary. The demographic information of the participants is given in Table 1:

Table 1 ***Demographic information of the participants***

Participant	Gender	Country	Mother Tongue	Age	Level
P1	F	Uzbekistan	Uzbek	18	C1
P2	F	Turkmenistan	Turkmen	19	C1
P3	M	Kazakhstan	Kazak	18	C1
P4	M	Indonesia	Indonesian	20	C1
P5	M	Congo	French	24	C1
P6	M	Kazakhstan	Kazak	19	C1
P7	M	Indonesia	Indonesian	22	C1
P8	F	Indonesia	Indonesian	20	B2
P9	F	Egypt	Arabic	18	B2
P10	M	Indonesia	Indonesian	21	B2
P11	F	Indonesia	Indonesian	19	B2
P12	M	Indonesia	Indonesian	20	B2
P13	M	Kazakhstan	Kazak	17	B2
P14	F	Indonesia	Indonesian	20	B2
P15	M	Indonesia	Indonesian	20	B2

Participant	Gender	Country	Mother Tongue	Age	Level
P16	M	Egypt	Arabic	20	B2
P17	M	Indonesia	Indonesian	19	B2
P18	F	Turkmenistan	Turkmen	19	C1
P19	F	Kazakhstan	Kazak	17	C1
P20	F	Kazakhstan	Kazak	18	C1

According to the table, 11 male and 9 female learners participated in the study; their ages ranged from 17 to 24. 10 participants continued their Turkish education at the B2 level, 10 at the C1 level, and all were international learners from Uzbekistan, Kazakhstan, Indonesia, Egypt, and Turkmenistan. Advanced-level learners at B2–C1 levels were chosen intentionally because they possess sufficient linguistic proficiency to articulate nuanced opinions about grammatical structures. It is known that all participants were high school graduates who had received Turkish preparatory education before beginning their undergraduate studies. The participants were coded as P1, P2, P3....

2.2. Data Collection

A semi-structured interview form was prepared to obtain learners' views and collect data. The views of 2 experts were obtained for the questions created during the preparation phase of the interview form. After the expert views were obtained, a 12-question interview form was created. The data was collected face-to-face by the researcher. At the beginning of the interview form, there is a section that collects information on gender, country, mother tongue, age, and level to determine participants' demographic characteristics. The first 4 questions on the form are “yes/no” questions, and the remaining questions are designed to determine the relationship between grammar and each skill. In addition to these, questions were asked to gather learners' views on the grammar courses in their current course syllabus. The data was collected by researcher in written form. The researcher conducted verbal interviews with participants and, at the same time, wrote down the participants' views and recorded audio. The data collected on paper was transferred to the computer environment by the researcher. The interview questions in the interview form are as follows:

1. Do you use the grammar you have learned in speaking skills? Yes ☐ No ☐
2. Do you use the grammar you have learned in writing skills? Yes ☐ No ☐
3. Do you notice the grammar you have learned while listening to a text or a person? Yes ☐ No ☐
4. Do you notice the grammar you have learned while reading a text? Yes ☐ No ☐
5. Do you think learning grammar is important while learning Turkish? Why?
6. Is it possible to speak, listen, write and read Turkish without learning grammar?
7. How does trying to use grammar correctly affect your speaking/motivation? Does the thought of using grammar incorrectly affect you negatively?
8. Does the thought of using grammar incorrectly prevent you from using the learned grammar while working on writing?
9. How does the thought of hearing a grammar rule you do not know while speaking Turkish with others affect you? How do you feel when you encounter grammar structures you do not know while listening to someone or a text?

10. How does the thought of encountering unfamiliar grammar while reading a text affect your understanding of the text? How do you feel when you encounter unfamiliar grammar while reading a text?
11. Would you prefer grammar to be given as a separate course or as part of reading/listening/writing/speaking courses? Why?
12. Do you think the number of grammar lessons is sufficient? Should the number be increased or decreased?

2.3. Data Analysis

The written data collected through the interview form was analyzed using content analysis. “By content analysis, key themes emerge from the documents after they are classified and coded. Content is analyzed by breaking it into conceptual chunks, which are then coded or named. Qualitative analysis develops the categories as the analysis takes place. The results are used to make inferences about the messages in the text” (Wilson, 2016, p. 41). The collected responses were analyzed using content analysis, and themes were determined and created. When creating themes, attention was paid to topics mentioned by at least two participants. Responses mentioned by a single participant but considered important for the research were included as other expressions.

2.4. Validity, Reliability, and Ethical Considerations

To ensure the rigor and trustworthiness of this study, strategies outlined by Merriam and Tisdell (2016) were employed to address credibility, consistency, and transferability. To establish credibility and ensure the findings accurately represented the participants’ perspectives, triangulation was used. Member checking was conducted by showing the written data to participants for double-check to confirm accuracy and ensure that the researcher’s interpretation aligned with the participants’ intent. Then the audio records and written forms were compared once again by the researcher. The researcher also engaged in reflexivity to monitor potential biases throughout the data collection process.

In qualitative research, reliability refers to the consistency of the findings with the data collected. To ensure this, an audit trail was maintained that detailed how categories were constructed and how decisions were made during the analysis. Furthermore, peer examination was utilized by taking the views of 2 experts to assess the plausibility of the emerging categories.

To allow readers to determine the applicability of the findings to other contexts, rich, thick description was provided. By presenting direct quotes, detailed information about participants' grammar programs, and participant variables, this study enables readers to determine the extent to which these findings transfer to their own situations (Merriam & Tisdell, 2016).

Prior to data collection, approval was obtained from the Institutional Review Board (IRB) under the number 2025-SBB-0870. Informed consent was ensured by providing all participants with a clear explanation of the study’s purpose, their right to withdraw at any time, and the measures taken to protect their privacy. To guarantee confidentiality, codes were assigned to all participants, and all digital data was stored on a password-protected personal drive.

3. Findings

The data obtained in this research, which was conducted to determine and evaluate the views of those learning Turkish as a second language on grammar and grammar lessons, were thematically tabulated. The participants' responses to the questions were directly opposite the themes. In

addition, the responses to the first four questions, which were restricted to “yes/no” answers, are shown collectively in the table below:

Table 2 ***Yes/No Responses for the first 4 questions***

Questions	Yes		No		Total
	(f)	%	(f)	%	(n)
1. Do you use the grammar you have learned in speaking skills?	20	100	0	0	20
2. Do you use the grammar you have learned in writing skills?	19	95	1	5	20
3. Do you notice the grammar you have learned while listening to a text or a person?	18	90	2	10	20
4. Do you notice the grammar you have learned while reading a text?	17	85	3	15	20

When the responses to the 4 interview questions, which were designed to directly determine views on the 4 basic language skills, were examined, all the students who participated in the research answered “yes” to the first question and stated that they used the grammar they had learned in speaking. It was determined that the “yes” response regarding the use of learned grammar in writing skills was 95%, the “yes” response regarding participants' listening skills was 90%, and the “yes” response regarding reading skills was 85%. This shows that learners use grammar in productive skills more than in receptive skills.

To understand directly if grammar is important for participants, the following question was asked:

5. Do you think learning grammar is important while learning Turkish? Why?

Table 3 ***Views about the importance of learning grammar***

Theme	Expression
For correct communication (P3, P6, P11, P15, P17, P18, P19)	*“It is important, to construct sentences correctly and to be able to explain correctly”, “Yes, it is important. Because grammar rules help to establish correct and effective communication.”, “It is very important because it is important in many things such as meaning, fluency, and self-expression.”, “Of course it is important. Learning grammar is important while learning every language because it allows constructing sentences correctly, helps to understand speech, and makes it possible to express thoughts without errors.”*
For academic life (P2, P4, P5)	*“Yes, it is important because it will be necessary when starting first grade.”, “Yes, because good grammar is the language used officially, especially in the educational world.”, “Yes, because learning new words and improving our Turkish for school is important.”*
For language skills (P8, P11, P12, P16)	*“I think learning grammar is important when learning Turkish because it helps me speak and write better.” “Yes, it is very important for listening.”*

The answers given to the question “Is learning grammar important when learning Turkish? Why?” directed to the participants in the table are evaluated under 3 themes. Most of the participants stated that grammar is important for proper communication, academic life, and language skills. Apart from these themes, P9 said “Yes, I think one of the important things when learning Turkish is grammar, because if you do not pay attention to grammar, you will not be able to learn Turkish quickly.”, and

P13 said "I think learning grammar is very important when learning Turkish because it is not possible to learn Turkish quickly without learning grammar." They answered as follows, stating that learning grammar and the language-learning process cannot be separated.

To see the participants' views on 4 language skills and grammar relationship, the following question was asked:

6. Is it possible to speak, listen, write, and read Turkish without learning grammar?

Table 4 ***Views about the effect of grammar on language skills***

Theme	Expression
Possible (P2, P9, P14, P20)	*"It is possible, if you only talk to Turks, it may take years.", "It is possible, but it takes a long time.", "I think it is possible."*
Not possible (P3, P6, P7, P8, P12, P13, P15, P16, P17, P18, P19)	*"You need to learn grammar every day, if you don't learn it, there is no use.", "I think it is not possible. If you don't learn grammar, you are wrong about writing and speaking, listening and speaking.", "It is not possible to speak, listen, write and read Turkish without learning grammar.", "It will not be easier to speak, listen and write Turkish without learning grammar."*
Both (P1, P4, P5, P10, P11)	*"It is possible but there are probably many mistakes.", "It is possible because I think language is a habit. The longer we stay in a place, the more fluently we can speak the language of that place. However, remember that language is not only an informal language. In some places, especially in the academic world, we need to use the official language.", "It is possible to speak, listen, write and read Turkish without learning grammar, but I think it is easier after learning grammar."*

Participants' responses on whether learning grammar influences basic language skills were evaluated across 3 themes. Since all participants' responses were related to these themes, there were no responses outside the themes. Those who think "it is possible" are on the same page that it takes much more time. However, as shown in Table 4, many participants believe that speaking, listening, writing, and reading are either impossible or difficult without learning grammar.

Most learners fear making grammar mistakes when speaking. This situation prevents them from speaking in other languages, and the biggest obstacle is speaking skills. To understand if the grammar affects their motivation for speaking, the following question was asked:

7. How does trying to use grammar correctly affect your speaking/motivation? Does the thought of using grammar incorrectly affect you negatively?

Table 5 ***Effect of grammar on speaking***

Theme	Expression
Motivating (P4, P8, P15, P20)	*"The better I understand grammar and use it correctly, the more confident I become when speaking and I can speak without stuttering.", "Paying attention to correct grammar motivates me to speak correctly.", "When we speak Turkish, when the grammar is correct and easily understood, this is one of the motivations for learning Turkish."*
Improving (P2, P9, P16)	*"It affects me well.", "No, I have spoken using incorrect grammar many times, then I realized my mistake and made up for it. On the contrary, it affects me positively.", "I speak better thanks to grammar."*
No impact (P1, P11, P13, P18)	*"Trying to use grammar correctly or incorrectly does not affect my speech at all.", "The thought of using grammar incorrectly does not affect me negatively."*

Theme	Expression
Negative impact (P3, P6, P7, P10, P12, P14, P19, P20)	*"Yes, I sometimes make mistakes when trying to use grammar rules correctly.", "Yes, using incorrect grammar makes it difficult for me to interact with others.", "I feel negative when I use incorrect grammar. In other words, I don't feel good about speaking.", "Yes, it affects me negatively. I'm actually afraid of speaking Turkish. Because I'm afraid of using incorrect grammar."*

The responses to the question about how to use grammar and the idea of using it incorrectly affected their motivation were examined under 4 themes: motivating, developing, ineffective, and negative impact. Apart from these themes, P17 expressed his thoughts as follows: "Grammar determines the meaning of the sentences we speak; therefore, grammar greatly affects speaking skills." These themes show that speaking with good, correct grammar positively affects them. However, to motivate them, it is quite important to know grammar well. Which situation is directly linked with the importance of grammar teaching?

Writing is a hard skill when it comes to writing in a foreign language. To see if the fear of using grammar in the wrong way prevented the participants from writing, the following question was asked:

8. Does the thought of using grammar incorrectly prevent you from using the learned grammar while working on writing?

Table 6 ***Effect of grammar on writing***

Theme	Expression
Prevents (P3, P7, P8, P11, P13, P14, P15)	*"It affects, I study it over and over again.", "Incorrect use of grammar prevents writing because I think grammar is important when writing.", "It prevents me from using grammar when writing.", "Yes, it prevents me."*
Does not prevent (P1, P2, P5, P10, P12, P16, P17, P18, P20)	*"No, because Turks understand you even if you make mistakes.", "No, it does not prevent me from using it because if I use it wrong, I will learn and I can use it better in the future.", "No, it does not affect.", "No, it does not prevent me."*
Sometimes (P4, P6, P9, P19)	*"Sometimes I use correct grammar incorrectly and this can change the meaning of what I want to say.", "Sometimes it can prevent me. Because of the fear of making a mistake.", "Indeed, it sometimes prevents me but this is how I learn because if I hear/see a different grammar, I immediately research what it is, where I will use it."*

Three themes emerged from responses to the question about the effect of grammar on writing skills. All participants' answers played a role in the creation of the themes. While some participants said that the thought of using grammar incorrectly prevented them from using grammar in their writing studies, the other two groups stated that it did not, and sometimes did.

For the listening and grammar relationship, the following question was directed:

9. How does the thought of hearing a grammar rule you do not know while speaking Turkish with others affect you? How do you feel when you encounter grammar structures you do not know while listening to someone or a text?

Table 7 ***Effect of grammar on listening***

Theme	Expression
Negative impact (P12, P19)	*"It affects me a lot because I don't understand and I wonder.", "Usually in such a situation I feel very embarrassed and scared."*

Theme	Expression
Difficulty in understanding (P3, P6, P9, P11, P12, P13, P14, P16)	*"I have a little difficulty.", "I may have a little difficulty at first and have difficulty understanding.", "I get a little confused and have difficulty understanding and I try to understand that grammar.", "I feel like I don't understand but maybe if I knew more verbs I would understand."*
Encouragement to learn (P8, P9, P10, P13, P14, P15, P17)	*"I ask and learn.", "If I hear a grammar rule that I don't know while speaking Turkish with others, I then research and learn.", "I get a little surprised when I hear a rule that I don't know while speaking Turkish. I try to understand, and I want to learn.", "When we hear a grammar that we have never heard before or don't know, of course this is a learning material for us."*
No impact (P2, P18)	*"There is no grammar that I don't know. They are all easy for me anyway.", "It has no effect."*

The responses participants gave to the question about encountering a grammar rule they had not encountered before in a conversation were evaluated under the headings: this situation affected them negatively, made understanding difficult, encouraged learning, and did not affect them. Some responses that could not be evaluated under the themes in this question about listening skills are as follows: P7: I'm a little surprised, but I understand. P20: I've never come across it before.

The last question about language skills and grammar is for reading. If the unfamiliar grammar prevents the participants from understanding the text, the following question was asked:

10. How does the thought of encountering unfamiliar grammar while reading a text affect your understanding of the text? How do you feel when you encounter unfamiliar grammar while reading a text?

Table 8 ***Effect of grammar on reading***

Theme	Expression
Need help (P5, P7, P8, P10, P11)	*"When I see a new word, I ask my instructor to explain it.", "I want to ask my instructor.", "I use Google Translate.", "If I don't understand a text while reading it, I ask my friend."*
Effort to understand (P9, P13, P14, P16, P17)	*"First, I reread it and try to understand it by finding the words I know.", "When I come across a grammar I don't know while reading a text, it becomes difficult to understand. Sometimes I stop and reread it.", "I won't understand the text while reading it and I will examine this new grammar.", "I don't understand it but I try to figure it out."*
Negative effects (P4, P6, P12, P15, P19)	*"I feel confused because I don't know it.", "If I don't understand the structure in the sentence, the meaning of the text changes.", "It affects me a lot because I don't understand it and I am curious. I definitely feel confused and sad.", "When I come across a grammar I don't know, I start thinking, "I don't know Turkish.""*
Not experienced (P1, P3, P18, P20)	*"I don't usually have such problems.", "I haven't experienced anything like that.", "There is no language I don't know.", "I haven't encountered this before."*

The responses to the question on how grammar affects reading skills were examined under 4 themes. When they encountered unfamiliar grammar while reading, some participants said they needed help, some tried to understand, some said the situation affected them negatively, and some said they had never experienced such a situation before. In addition, P2 stated that he was not affected by this situation by saying, "It does not affect it in any way."

Participants were taking 8 hours of grammar lessons per week, totaling 48 hours per language level.

As stated in the "Method" section, participants were taking separate grammar lessons. To learn their view on this situation, the following question was directed:

11. Would you prefer grammar to be given as a separate course or as part of reading/listening/writing/speaking courses? Why?

Table 9 ***Preference about grammar and skill lessons***

Theme	Expression
A separate lesson (P7, P12, P13, P14, P15, P17, P18, P19, P20)	*"I prefer it to be taught in separate lessons. Because it is easier to understand.", "I prefer it as a separate lesson because we can understand it better. If it has rules, we can understand it more easily.", "I think it would be better if grammar topics were separated.", "I would like it to be a separate lesson because sometimes I cannot concentrate because of other lessons."*
With skills (P2, P3, P4, P5, P8, P10, P11)	*"It should be in it because in my view, as a foreigner, we should understand the function and meaning of that grammar in detail.", "Yes, it is really important because, for example, if a person is learning a foreign language, they have to write, listen, read or speak. It is a part of developing the language.", "I prefer it to be in the reading, listening, writing and speaking lessons because it is easier to understand."*
Doesn't matter (P1, P16)	*"It doesn't matter.", "I don't think it matters."*

The responses received from participants regarding whether grammar lessons should be planned as a separate lesson from skills or as an integrated lesson with skills were addressed under 3 themes. While some participants wanted grammar lessons to be separate, others wanted them combined with skills. In addition, some participants stated that this situation would not make any difference for them.

To see their thoughts about the sufficiency of the lesson number, the following question was directed:

12. Do you think the number of grammar lessons is sufficient? Should the number be increased or decreased?

Table 10 ***Views about number of grammar lessons***

Theme	Expression
Unsure (P1, P5)	*"Depends on the course and level."*
Sufficient (P2, P3, P4, P6, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18, P20)	*"The number of grammar lessons is sufficient.", "The lessons are sufficient.", "I think the grammar we learn is sufficient because we learn commonly used topics while speaking."*
Insufficient (P7, P8, P19)	*"I think a grammar lesson should be added.", "I think the number of grammar lessons is insufficient. The number should be increased.", "I think it would be good if the grammar lessons were increased a little more."*

Since all participants were enrolled in the Turkish preparatory education program at the same institution, they were asked whether the current grammar courses were sufficient. While the majority of participants found the number of grammar courses sufficient, 3 participants found it insufficient. 2 participants were undecided about the number of grammar courses.

4. Discussion and Conclusion

First of all, the biggest limitation of the study is that it is conducted at the same institution; therefore, these findings cannot be generalized to all Turkish second- or foreign-language learners. The study's conclusion applies only to those learning Turkish with the same grammar program at the same institution. However, these findings give some cues about the learners' views on grammar.

In this study, conducted to determine participants' views on grammar in Turkish as a second language, 12 questions were asked, and their general views on grammar and those based on language skills were determined. The following conclusions were drawn from the themes identified in the participants' responses.

The first research question of the study was whether learners notice Turkish grammar in their use of Turkish. In this respect, 4 yes/no questions were asked of the participants. The aim of these questions was to examine the participants' tendency to use the grammar they learned in production skills and their perception of the different grammar learned in reception skills. When the participants' responses were examined, it was found that they tended to use the learned grammar at a higher rate in productive (speaking and writing) skills. All the participants stated that they tried to apply the grammar they learned in their speaking. In writing skills, all participants except 1 stated that they use the grammar they learned. While speaking skills are learned in a natural process, writing skills require an educational process to be acquired (Kurtoğlu & Alkan Serin, 2025). On the other hand, the majority of participants in the listening and reading (reception) skills stated that they noticed the grammar points they had learned. While this rate was 90% in listening skills, it was 85% in reading skills. Speaking skills are learnt after listening skills. It is known that writing skills are generally taught after listening, speaking, and reading. However, when teaching Turkish as a foreign/second language, it is common knowledge that writing is the most difficult language skill for learners to master (Şimşek & Erdem, 2021). While grammar use is not the only factor in this situation, grammar also has a significant impact on writing skills. However, the data from this study indicate that while learners are more successful in using grammar, recognizing grammatical structures is more difficult in receptive skills.

To answer the second research question about how grammar affects learners' language skills, learners were asked whether grammar is important. Learners believe that grammar is an integral part of the language-learning process. In particular, the ability to communicate effectively is the main reason for this. According to learners, learning grammar is essential for proper communication. Without good grammar, it is not possible to communicate properly, as proper grammar prevents misunderstandings that may occur when expressing thoughts and ideas (Afroogh, 2019). At the same time, being successful in academic life depends on learning grammar. Learners think that they can improve their language skills through grammar.

According to most participants in the study, the key to success in reading, speaking, listening, and writing is learning grammar correctly. Gilakjani & Sabouri (2017) concluded in their research on this subject that learners have more positive attitudes towards learning grammar than instructors do, and that they believe they can develop their communication skills faster by learning and applying grammar. However, some learners pointed out that if they have the chance to talk to Turkish people, they can learn Turkish without any formal grammar. On the other hand, some say it is possible to learn Turkish without grammar, but this version of the language is suitable only in informal settings. In the academic world, they consider grammar essential. This is proof that students see grammar as a tool, not a goal.

When asked about their use of grammar in speaking and its effect on their motivation, participants' responses were largely positive. In order to acquire speaking skills, it is necessary to know the rules of the language, namely grammar and pronunciation, and to teach all of these in conjunction with each other (Çelik, 2019, p. 37). The learners stated that trying to use grammar correctly motivates them and improves their language skills. The findings of the study show that when they make a grammatical mistake while speaking, they realize this mistake and make more effort not to repeat it and try to correct their mistakes. In addition, the use of incorrect grammar during speaking negatively affects some participants and prevents them from interacting. The learners stated that they experience communication gaps due to their focus on using grammar rules correctly. It is clear that this situation negatively affects their motivation to speak. When it comes to speaking, although learners feel competent and participate in situations that require simple language, instructors report that learners avoid contributing to faculty courses (Konyar & Yılmaz, 2021). For this reason, correct grammar and speaking skills should be taught together. There are also some views that the idea of using grammar correctly has no impact on speaking skills.

Gürbüz & Güleç (2016) state that learners have difficulty with grammar, which negatively affects writing skills. The answers to the interview question about the effects of grammar on writing skills indicate that incorrect grammar does not undermine the writing motivation of most participants. At this point, textbooks again have a very important task. It is essential that textbooks are prepared with the cases and examples that learners encounter in real life in mind. When learners learn grammar rules as presented in grammar textbooks, the application and outputs are unsuccessful. Exposure to language helps learners increase their ability to notice discourse and language features (Hinkel, 2008). Participants stated that even if they made mistakes, Turks somehow understood them, and their motivation was not affected because they knew this. However, some participants also expressed the opposite. According to them, the idea of using incorrect grammar prevented the participants from writing. They stated that they avoided using the new grammar rules they learned due to the fear of making mistakes. Another group said that this did not always prevent them from learning, that they sometimes had problems, but that their motivation to learn increased as a result of these mistakes.

According to students' views, being unable to understand due to a lack of grammar is one of the difficulties they encounter during listening activities in learning Turkish as a foreign language (Halat, 2015). According to the answers given regarding how grammar and listening skills affect learners, it was concluded that not knowing the grammar encountered negatively affects listening skills. Participants stated that when they encounter a grammar rule they do not know while listening, they are negatively affected and have difficulty understanding. One group stated that this situation encourages learning, while a very small number of participants reported that it has no effect on listening. Participants pay particular attention to grammar in writing, while stating that they can communicate meaningfully without using grammar in speaking. However, this situation negatively affects their receptive skills, such as reading and listening. Although they try to make sense of the general context in reading, they state that communication does not occur and that they cannot grasp the meaning when they encounter such a situation in listening. In the process of learning Turkish as a foreign language, learners are often required to understand and respond to unfamiliar structures, words, and sentences; these concepts, which were not part of their prior learning and are encountered for the first time, can cause anxiety in communication (Altunkaya, 2017).

Learners stated that when they encounter a grammar rule they are unfamiliar with while reading, they ask their instructors or peers for help and try to infer its meaning from its use in the text. While some

participants said that this situation affected them quite negatively, they even felt as if they did not know Turkish at all when they encountered this situation, a few participants said that they had never encountered such a situation before. The learners who participated in the study believe that knowledge of grammar is important for good reading skills. Regarding the relationship between grammar and reading comprehension, Grabe & Stoller (2013) stated that solid knowledge of language structure and vocabulary is needed for reading to be fluent and effective. However, Sapoetra (2017), in his study examining the effect of grammar knowledge on reading skills, concluded that good grammar knowledge does not directly affect reading comprehension.

When it comes to the relationship between grammar and motivation, it is obvious that when learners cannot use grammar in the 4 basic language skills, cannot communicate due to grammatical issues, or experience a loss of meaning, these situations negatively affect their motivation. To prevent this situation, grammar instruction can be conducted through language-thought analysis, as suggested by Avcı & Küçük (2017). With this method, in addition to grammar rules, the aim is to present and apply these rules at the levels of words, sentences, and texts in teaching grammar. However, when the opposite happens, learners are motivated, and their motivation to learn increases. They are curious about the grammar rules they do not know and try to learn them.

To gather learners' views on the formal structure of grammar courses, two final questions were asked during the interview. Due to the lack of a common program, one of the biggest problems in teaching Turkish as a foreign/second language, course planning and syllabi at each institution differ. Grammar courses are conducted as separate courses in the institution where the research was conducted. When the participants were asked about their thoughts on this issue, although some argued that this situation did not affect the language learning process much, others demanded that it be planned as a separate course that includes skills. Those who argued that it would be more efficient to plan grammar courses as a separate course stated that they would understand the rules better in this way and that they had difficulty focusing on grammar when it was intertwined with skills. Those who demanded that grammar courses be included with language skills stated that they could only learn the function and meaning of grammar rules in this way. Although many instructors are aware of the trend toward integrating grammar with language skills and tasks, they fail to implement it in practice. The main reason is that textbooks are prepared using traditional grammar-based teaching methods. At this point, a solution to this problem would be for instructors to use textbooks only as references and to teach grammar through task-oriented activities in practice (Adhikari, 2018). However, to proceed in this way, instructor competencies must be complete. “Independent grammar lessons, having different instructors in the lessons, using grammar books prepared as supplementary books in the lessons, holding independent grammar exams, etc., are not consistent with the understanding that ‘language teaching is a whole and grammar teaching is a tool that supports the four basic skills in language teaching.’ This situation prevents the equal development of the four basic skills and the immediate detection and correction of student errors” (Özel, 2010, p. 157). It is important to remember that the purpose of language education is not only to understand the mechanics of a language, but also to communicate effectively in that language. Integrating skills with knowledge of grammar is a step towards achieving this goal (Alisoy, 2023).

The last interview question in the research is whether the number of grammar lessons is found to be sufficient by the learners. In this regard, the majority of the learners find the number of grammar lessons sufficient. However, a few participants also find the number of grammar lessons insufficient or are undecided on this issue. As stated before, due to the lack of a program, it is not possible to make a definitive right-or-wrong statement about the number of grammar lessons.

A noteworthy aspect of the findings concerns the role of the participants' linguistic backgrounds. Extant literature on Second Language Acquisition (SLA) often posits that learners from typologically related languages—specifically those from Turkic backgrounds—benefit from positive transfer, potentially leading to lower perceived difficulty and different learning strategies compared to learners from unrelated language families (Atilla, 2001; Ringbom, 2007; Karatay & Kartalıoğlu, 2012; Biçer & Alan, 2019). However, contrary to these theoretical expectations, the qualitative analysis in the current study found no significant differences between the perceptions of Turkic-origin students and those of other international students. Both groups consistently agreed on the same themes. This finding suggests that the instructional context and the specific pedagogical methods employed may play a greater role in learners' perceptions than linguistic proximity. In other words, the challenges of learning grammar appear to be universal in this classroom setting, overshadowing the potential advantages of learners' L1 backgrounds.

4.1. Suggestions

The majority of learners think that learning grammar lessons, grammar rules, and the grammar of a language is important for reading, writing, speaking, and listening to that language. Although current studies emphasize the importance of grammar instruction, they also argue that these lessons should not be separated from skills and that the main focus should be on skills. Institutions that teach Turkish should plan grammar teaching in a functional way and integrate it with basic language skills. However, completely ignoring grammar instruction would be a very wrong practice, and given that learners' needs and demands are to learn grammar well, it should definitely be considered.

Regarding speaking skills, most participants stated that their fear of using grammar incorrectly negatively affected their ability to speak. To help students overcome this negative feeling, it is crucial to prioritize speaking skills in classes, provide constructive correction during speaking activities, and encourage students to use the grammar they learn in their speaking.

When writing skills are examined, it is evident that participants' concerns about using grammar incorrectly do not significantly hinder their writing, though some still have problems due to these concerns. It would be beneficial to do writing practice on the relevant grammar topic after each grammar topic on the use of grammar in writing skills, to have the writing work checked by the instructor, to give feedback to the students, and to make collective corrections to mistakes through peer evaluation.

Participants were found to have one of the greatest difficulties understanding the skill of listening, especially when faced with unfamiliar grammar. To avoid this, taking notes while listening and following along with the text will help discover grammatical structures in listening.

The grammar topics in the reading text have a more negative impact on students. Students have stated that they need help from a teacher or a friend when they encounter unfamiliar grammar, and this has negative effects. To prevent this, students can be advised to use dictionary while reading, and they should also be provided with supplementary reading materials beyond the textbook that cover the grammar topics they are learning.

In future studies, in addition to taking learners' views on grammar teaching in much more detail, it can be measured whether grammar teaching affects the success of Turkish as a foreign language learners in language skills. Thus, regardless of learners' views, treating grammar as a variable will concretely reveal how grammar instruction affects instructors' Turkish language skills.

5. Declarations

5.1. Author Contributions (CRediT)

Author 1 (Öykü Mercan Çetin): Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization.

5.2. Conflict of Interest

The author declares no conflicts of interest.

5.3. Funding Statement

The authors declare they have not received specific financial support for the research.

5.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

5.5. Ethics Approval

Ethical approval for this study was granted by the Bartın University Rectorate Social and Humanities Ethics Committee (Approval No: 2025-SBB-0870; Approval Date: 10.09.2025). Prior to data collection, participants were fully informed about the scope, purpose, and responsibilities of the study, as well as its potential risks and benefits. Assurance was provided that all personal information would be carefully protected. All participants agreed to take part voluntarily, without any pressure or persuasion, and written informed consent was obtained from each participant.

5.6. Use of Artificial Intelligence (AI) Tools

None

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Evaluation of scratch-based educational digital games from the perspectives of prospective teachers

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ABSTRACT

This study evaluates educational digital games developed in Scratch from the perspective of prospective primary school teachers. This research investigated participants' perceptions of educational digital games (EDGs), their experiences with these games, and their views on EDGs' contribution to mathematics instruction. The study used a phenomenological design, which is a qualitative research approach, and involved 16 final-year prospective teachers from the primary education department of a state university's faculty of education during the 2023–2024 academic year. Data were collected through semi-structured interviews and analyzed using content analysis. Five themes emerged from the findings: the concept of educational digital games, their use in mathematics teaching, game design, challenges encountered in the games, and feedback on design. Participants defined EDGs as effective instructional tools that capture students' attention, make learning enjoyable and lasting, and help to concretize abstract concepts. Overall, the findings suggest that educational digital games can enhance student motivation and conceptual understanding in mathematics education and serve as a valuable tool for developing pre-service teachers' digital pedagogical competencies.

KEYWORDS: Educational Digital Games; Scratch Program; Mathematics Education

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1. Introduction

The rapid growth of portable devices and digital technologies has directly impacted educational processes. New technologies are integrated into educational environments to facilitate and reinforce learning and provide more interactive learning experiences. The concept of play has also become digitized, and children's and students' play habits have become significant variables shaping learning processes as they integrate with technology use practices (Gee, 2003; Prensky, 2001). Furthermore, game-based learning approaches are gaining importance, and it has been emphasised that digital games can support the learning process, particularly in mathematics teaching (Gök, 2020). In this context, digital games have significant potential, especially in mathematics teaching, to reduce learning difficulties and help students understand abstract concepts. Mathematics instruction has a structure that demands varying levels of conceptual understanding, depending on students' individual differences. Consequently, although students learn mathematical concepts more easily, learning difficulties become more evident in certain subjects, especially those with high levels of abstraction. One of the main reasons for this is that certain mathematical concepts are more readily

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integrated into mental processes, whereas others have more complex cognitive structures. For instance, fractions are among the most challenging topics for students to conceptually understand (Dehaene, 2020). Thus, there is a need for innovative teaching tools that can increase students' engagement in the learning process and facilitate the comprehension of abstract concepts. The increasing digitalization of educational environments has diversified teaching materials in parallel with this transformation. Game-based learning approaches enhance student motivation, make learning enjoyable, and offer a powerful alternative to traditional instructional methods (Çetin, 2013). Recent research also shows that interest in the use of digital games in mathematics education is rapidly increasing and that research in this field has grown considerably (Poçan, 2023; Engin, 2023).

It is believed that developing effective digital tool design skills is essential for teachers before graduating from teacher training programs (Özdemir, Basır, Balbay, Meredova, et al., 2021). Being competent in designing and utilizing digital tools not only strengthens the professional qualifications of prospective teachers but also affects teaching quality across disciplines. Mathematics as a discipline and mathematics teaching are areas where the impact of digital pedagogical competencies is evident. Teachers who integrate digitalisation into their mathematics instruction can more effectively engage students. Computer games provide alternative solutions and perspectives for addressing difficulties and motivational challenges in subjects such as multiplication tables, vocabulary acquisition, language learning, pronunciation, writing, formulas, and rules (Çetin, 2013). Consequently, it has become critical for prospective teachers to develop these competencies and master technology-supported teaching processes to increase student engagement.

Mathematics is considered a compulsory subject globally, at all levels from primary school onward, as it was in ancient times (Demir, 2019). Indeed, fostering students' enjoyment of mathematics from the outset of primary school is an essential concern for classroom teachers. Schools are entirely different worlds for students who begin their education. To help students who leave their family environment for the first time adapt more easily to school, greater emphasis should be placed on play-based activities in the learning process (Baltayeva, 2021). Using games to teach mathematics in primary school has proven highly effective, and the use of mathematical games is particularly important, especially for students in the early grades (Doğan, 2019). As emphasised in Boz's (2018) study, concretizing abstract mathematical concepts by relating them to students' experiences and through play significantly supports conceptual understanding. Intelligence games, especially those implemented at the primary school level, are among the effective tools that contribute to this concretisation process in mathematics teaching. In addition, developing digital versions of these educational games enables mathematical concepts to be conveyed in a more comprehensible, enduring, and structured manner.

Fractions, one of the more complex forms of the number concept, help students understand the relationships between numbers by illustrating the whole-part relationship. There is a growing demand for innovative teaching tools that can engage students and support conceptual understanding in teaching conceptually abstract and challenging topics such as fractions. With the digitalization of educational environments today, teaching materials are diversifying in parallel. Notably, game-based digital learning applications both capture the attention of primary school students and provide interactive environments that enhance conceptual understanding.

The primary objective of this research was to evaluate the contribution of two educational digital games developed using the Scratch program to the teaching process, aligned with the requirements of the digital age, to enhance primary school students' conceptual understanding of fractions. This research also seeks to identify prospective primary school teachers' perspectives on the design of

educational digital games for mathematics instruction. Accordingly, the impact of prospective teachers' experiences with the digital game design process on their creative thinking, problem-solving abilities, and technology-based teaching skills is also a focal point of research. The study not only assesses the contributions of digital game-based teaching to mathematics learning but also highlights the need to incorporate innovative practices, such as educational game design, into teacher training programs.

Game-based approaches are regarded as essential alternatives for overcoming the difficulties encountered in mathematics instruction. Recent research indicates that interest in using digital games in mathematics education is rapidly increasing, and the number of studies in this field has grown considerably (Poçan, 2023). Educational digital games not only foster positive attitudes towards learning but also help concretize concepts. In this respect, the use of digital games to teach abstract concepts is an effective method for enhancing learning retention (Boz, 2018; Doğan, 2019). In this context, the use of digital games in teaching fractions offers a significant opportunity to improve students' conceptual understanding. Game-based learning approaches capture students' attention and make learning more enjoyable, particularly at the primary school level (Baltayeva, 2021). However, for effective integration of digital games into mathematics teaching, teachers must possess adequate knowledge and skills in this area. Teacher candidates' experiences in digital game design both facilitate the integration of technology in the instructional process and foster their creative thinking and problem-solving skills (Özdemir, Basır, Balbay, Meredova et al., 2021).

Existing research demonstrates that studies on the use of game-based digital tools in mathematics education primarily focus on middle and high school levels (Gök & İnan, 2021; Taş et al., 2023; Demir & Bilgin, 2021); however, research on fractions at the primary school level remains limited. This study addresses a significant gap in the literature. Additionally, research examining pre-service teachers' experiences with the digital game design process is quite scarce. Therefore, this study offers original data regarding the development of digital pedagogical skills in teacher training programs.

Furthermore, while most studies on the use of block-based programs such as Scratch in education focus on student achievement (Permatasari, Yuana & Maryono, 2018; Çilengir & İzmirli, 2023; Çakıroğlu & Muştuoğlu, 2025), this research offers a different, application-oriented perspective by examining prospective teachers' experiences. Additionally, this study is expected to contribute to the literature by highlighting the significance of innovative teaching practices in teacher training programs. Digital game-based instruction not only supports student learning but also enhances prospective teachers' technology integration skills. Within this framework, the research aims to examine how educational digital games developed through Scratch contribute to the teaching process in developing primary school students' conceptual understanding of fractions. In this regard, the following research questions were addressed:

1. What are the prospective primary school teachers' perspectives on the concept of educational digital games?
2. What are the prospective primary school teachers' perspectives on the use of educational digital games in mathematics instruction?
3. What are the prospective primary school teachers' perspectives on educational digital games designed for mathematics instruction?

2. Theoretical Background

When we discuss block-based game design, Scratch is one of the first programs that comes to mind and is favored by teachers and teacher candidates for its ease of use and simplicity. Studies on Scratch have been conducted across the fields of science, mathematics, and visual arts, primarily focusing on middle school students. When adequate resources are available, educational digital games developed using Scratch can support teaching and learning. Both domestic and international research (Fang, 2012; Korkmaz, 2012; Korkmaz & Altun, 2014; Lau & Yuen, 2011; Maloney et al., 2010) confirms the effectiveness of digital games, educational digital games, and Scratch in teaching; however, research addressing the use of these tools in mathematics is limited. In both contexts, it is emphasized that digitalization and the use of Scratch facilitate learning and positively impact the teaching-learning process. Scratch facilitates mathematical thinking by fostering creative problem-solving and the development of logic and reasoning in response to various forms of feedback (Calder, 2010). Mathematical games designed with Scratch have been shown to reduce learning difficulties in mathematics for many students (Çubukluöz, 2019). Research by Selva Büşra Turan (2022) found that using Scratch enhances computational thinking skills and introduces fun and variety into mathematics instruction. Seher Avcu's (2023) research, however, indicated that prospective teachers reported that designing digital mathematics games with Scratch is time-consuming, may present coding challenges, and requires teachers to possess sufficient knowledge and skills in using Scratch.

3. Method

This section outlines the research design, sample selection, data collection procedures, validity and reliability of the data collection instruments, and the data analysis methods.

3.1. Research Design

A phenomenological research design was employed to examine how prospective primary school teachers conceptualize and experience "educational digital games" and to investigate their effects on them. Phenomenology is used to examine how people interpret their personal experiences and focus on the nature of meaning-making (Patton, 2002).

3.2. Participants

In qualitative research, purposeful sampling is used to identify suitable participants. Additionally, the study's purpose, research questions, and context must be carefully considered when selecting the sample. In this context, critical case sampling, a form of purposive sampling, was used. The rationale for purposeful sampling was to select information-rich cases for more in-depth research. In purposeful sampling, the researcher determines the purpose based on the information to be conveyed (Patton, 2002/2014). Therefore, a phenomenological design was used, and purposive sampling was employed to examine how prospective primary school teachers conceptualize and experience "educational digital games" and to investigate their effects on them. The sample comprised 16 final-year students from the Division of Classroom Education, Department of Primary Education, Faculty of Education, Pamukkale University. The research data were collected through semi-structured interviews with prospective primary school teachers during the spring semester of the 2023–2024 academic year.

Participants were voluntarily selected and informed of the research purpose before the study, and they provided written consent. Ethical approval was also obtained for the research. The number of

participants was within the recommended sample size range for phenomenological studies, and data saturation was achieved through the interviews.

Table 1 ***Distribution of Prospective Primary School Teachers by Demographic Variables***

Variables		f	%
Gender	Female	10	%62.50
	Male	6	%37.50
Digital Game Playing	Yes	9	%56.25
	No	7	%43.75
Period of Digital Game Playing	Currently	5	%55.55
	7-15 years old	4	%44.45
Digital Game Players' Gender	Female	5	%55.55
	Male	4	%44.45
Non-Digital-Game-Players' Gender	Female	5	%71.42
	Male	2	%28.58

Table 1 shows that women constituted the majority of participants (62.50%). Furthermore, 56.25% of the participants reported playing digital games, while 43.75% reported not playing games. Among those who played digital games, 55.55% reported they were still playing, and 44.45% reported they had played at a young age. The gender distribution of digital game players showed that the percentage of women (55.55%) was similar to that of men (44.45%). In contrast, among participants who do not play digital games, the proportion of women (71.42%) exceeds that of men (28.58%).

Semi-structured interviews were conducted at the Faculty of Education in a suitable venue on a day and time determined by the participants. Research data were collected from interviews with prospective teachers. After the interviews, which lasted an average of 11 minutes, the data obtained were transferred to a computer. During the interviews, participants were asked to share their knowledge of digital games and the Scratch program, and to evaluate the usability of the designed educational digital games for mathematics instruction, as well as their visual and technical features, organizational structure, and curriculum alignment.

3.3. Data Collection Tool

Semi-structured interview forms were used to collect data for this research. A qualitative data collection method, semi-structured interviews rely on predetermined, basic questions but also allow for flexibility in asking additional questions based on participants' responses (Cresswell, 2013). This method was chosen as a suitable tool for gaining an in-depth understanding of participants' experiences, opinions, and perceptions.

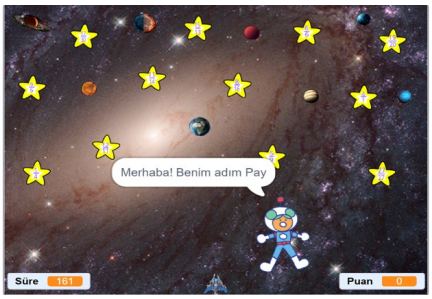
The preparation of the semi-structured interview form involved four stages: (1) Determining Research Questions — interview questions were developed in accordance with the fundamental questions and objectives of the research; (2) Structuring the Questions — open-ended questions were designed to allow participants to express their opinions freely; (3) Expert Opinion and Pre-Test — the designed

form was submitted to field and subject matter experts for review and was revised accordingly (Yıldırım & Şimşek, 2018); (4) Finalisation — the form, which initially comprised 15 questions, was reviewed and the number reduced to 13, with pilot interviews conducted with three students outside the main sample. Sample questions included: “What are your views on the use of educational digital games in mathematics instruction?” “What challenges did you encounter while playing the designed games?”, and “How would you evaluate the games in terms of their suitability for the curriculum?”

3.4. Role of Researchers and Educational Digital Game Design (Scratch Learning Process)

Various educational digital game designs (EDGs) are implemented at every stage of education, from primary school onward. The Scratch program is seen as a coding tool used in education and has become widespread with digitalisation. Block-based and free, Scratch can be used online and offline and can run on both desktop computers and various mobile devices. In this study, the researcher conducted comprehensive preliminary research into digital game design and the Scratch programming language before initiating the EDG design process. Through online resources and instructional videos, the researcher became familiar with the Scratch interface, menu options, and game design. After a learning period of approximately 1 to 1.5 months, the researcher attained proficiency in designing various digital games, such as snake, maze, and football games. Having acquired the necessary knowledge and skills, the researcher then developed two digital games covering proper, improper, and mixed-number fractions, aligned with the learning outcomes of the 4th-grade elementary school mathematics curriculum. A classroom teacher was consulted for feedback on the games, and refinements were made accordingly.

Figure 1 ***Space Game***



The astronaut “Pay” gives the player instructions on earning points by traveling through planets and stars in a spaceship. The space game is played using the space bar, arrow keys, and mouse.

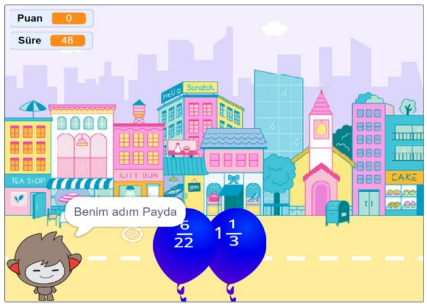
Figure 2 ***Space Game***

The game aims to foster interdisciplinary connections by enabling players to explore planets before the game begins. When players click on a planet, they hear a unique sound for that planet and can learn about it, establishing connections across multiple disciplines.

Figure 3 ***Space Game***

The primary objective is for players to start collecting points when they land on proper fraction stars and earn +6 points within 60 seconds. If the player lands on an improper fraction star instead, their score decreases by 1 point. If the player fails to earn +6 points within the allotted time, Astronaut Pay will encourage them with the message “Try again, don’t give up…”

Figure 4 ***Balloon Popping Game***



In the balloon-popping game, after choosing a colourful city, colourful balloons are programmed to fly around. Balloons serve as puppets, and the Nano puppet “Payda” functions as the avatar. The balloon-popping game is played only with the mouse.

Figure 5 ***Balloon Popping Game***

In the first balloon game, the objective is to start earning points by clicking on improper fraction balloons and to earn +6 points within 30 seconds. If the player clicks on a proper fraction balloon, a warning sound plays, and no points are earned. If the player cannot earn +6 points in time, the Avatar (Nano) “Payda” will encourage them with “Try again, don’t give up.”

Figure 6 ***Balloon Popping Game***

Under the same guidelines and rules, the final game aims to pop mixed-number-fraction balloons. Sound effects play an essential role in Scratch designs; in the balloon-popping game, a balloon-popping sound and a warning sound for incorrect clicks are used.

3.5. Data Analysis

The qualitative data obtained in the study were analysed using content analysis. The analysis process followed the procedures outlined by Miles and Huberman (1994) and Yıldırım and Şimşek (2022). In this context, the participants' statements were first transcribed, and the texts were read multiple times to ensure familiarity with the data. The data were examined using the open coding technique, and sub-codes were generated from expressions with similar meanings. These codes were grouped within the framework of semantic integrity, categorised, and finally developed into themes. Throughout the coding and thematicization process, the data were continuously reviewed, and care was taken to ensure consistency and validity across themes.

3.6. Data Reliability

To increase coding reliability, two researchers independently coded the data; the resulting codes were then compared, and any agreements and disagreements were discussed. Inter-coder agreement was calculated using the formula proposed by Miles and Huberman (1994), and the mean reliability for the themes was 96% (range: 75–100), indicating agreement between the researcher and the independent expert. Direct quotations from participant statements were included to support the findings and strengthen the validity of the interpretations. Both inductive and deductive approaches were used during the analysis.

4. Findings

Content analysis of interview data from prospective teachers identified five primary themes: Educational Digital Games, Application of Educational Digital Games in Mathematics Instruction, My Design, Challenges Encountered in the Game, and Feedback on Design. Pseudonyms were assigned to all participants to ensure confidentiality.

4.1. Educational Digital Games

Participants were asked about their understanding of educational digital games. They described these games as tools that are educational, teach through entertainment, are outcome-oriented, reinforce lessons, and positively influence students. Four sub-themes were identified: Learning Through Fun, Attention Engagement, Reinforcement Tool, and Outcome-Oriented Learning (Figure-7).

Figure 7 ***Educational Digital Game Theme and Sub-Themes***

4.1.1. Learning Through Fun

Participants indicated that educational digital games serve not only entertainment purposes, but also support students' learning processes by enabling them to learn through fun.

> Damla, "digital games are for spending free time, ... educational digital games are for teaching and entertaining."
>
> Nehir, "digital games are for spending my free time, they entertain... educational digital games... students both have fun and learn something."

4.1.2. Attention Engagement

Participants observed that educational digital games play a significant role in capturing students' attention during the lesson.

> Ahmet, "As someone who enjoys games, I find it essential that a game captures attention at the outset..."
>
> Ayşegül, "In first and second grades, students' attention is often easily diverted. However, when I introduce content through a game or an application on the smart board, students become more attentive, and the lesson becomes more engaging... I tried it in third grade and fourth grade as well, and I observed similar results; they demonstrated increased focus during lessons..."

4.1.3. Reinforcement Tool

Participants indicated that educational digital games are used to reinforce students' achievements in lessons and to further support their learning.

> Kaan, "digital games ... are intended for entertainment, while educational digital games ... are to reinforce learning lessons."
>
> Ela, "they are...used to reinforce learning outcomes..."

4.1.4. Outcome-Oriented Learning

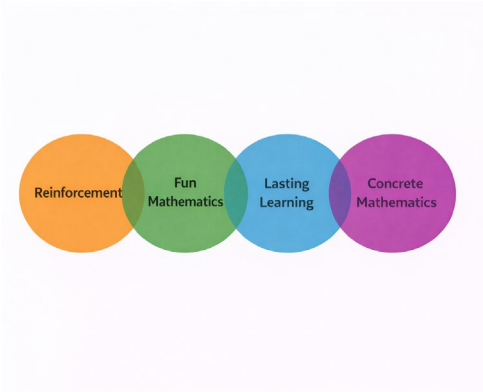
Participants indicated that educational digital games are intentionally designed to align with curriculum learning outcomes and contain content that supports educational objectives.

> Lale, "digital games are not designed according to specific purposes and instructions, whereas educational digital games are games developed in accordance with the learning outcomes outlined in the curriculum."
>
> Elif, "digital games are primarily for enjoyment and generally do not contain educational content, whereas educational digital games address subjects related to specific learning outcomes..."

4.2. Application of Educational Digital Games in Mathematics Instruction

Prospective primary school teachers were asked about the potential effects of educational digital games on mathematics instruction. They stated that the use of educational digital games could make lessons more engaging and tangible, effectively reinforce the lesson, and promote retention. Four sub-themes emerged: Reinforcement, Fun Mathematics, Lasting Learning, and Concrete Mathematics (Figure-8).

Figure 8 ***The Theme of Using Educational Digital Games in Mathematics Teaching and Sub-Themes***



4.2.1. Reinforcement

Zeynep, "...I think they are very effective, ... as we are in the digital age, students are interested in games, so educational digital games are important in education and greatly contribute to reinforcement. I also find them beneficial in mathematics instruction as they allow students to learn without becoming bored."

Fatma, "...there are positive aspects. ...educational digital games may be suitable for reinforcing instruction."

4.2.2. Fun Mathematics

Elif, "It can be enjoyable, after all, there are competitions or various appealing visuals. They can be used in math teaching... so they can be used in math teaching, it would be fun."

Mehmet, "For lessons to be enjoyable and for students to take pleasure in learning, they need something fun. These games are both educational and fun, and I find them quite useful. They can be used especially in math teaching."

4.2.3. Lasting Learning

Damla, "... math is a bit challenging subject for children in general... games both entertain children and make learning more permanent, so I think they can be used in math..."

Veli, "...Concepts are more memorable for students, that is, we actually integrate them into their daily lives because they are doing themselves, they are playing themselves, so I think games enhance retention and facilitate learning."

4.2.4. Concrete Mathematics

Hasan, "...children think concretely, and since mathematics is abstract, it is beneficial to make it concrete and teach it through games."

Jale, "...because mathematics is a highly abstract subject; many topics are difficult for children to visualise in their imagination. Therefore, I think it is useful to concretise and visualise topics."

4.3. My Design

Prospective classroom teachers were asked for their opinions on the educational digital game developed by the researcher. Participants generally reported that the game aligned with the curriculum, contained attention-grabbing elements, featured an engaging space-and-planet theme, had a clear, straightforward design, and effectively enhanced student motivation. Five sub-themes were identified: Curriculum Alignment, Attention-Grabbing Design, Reinforcement-Oriented Design, Motivational Value, and Clear Explanations (Figure-9).

Figure 9 ***My Design Theme and Sub-Themes***

4.3.1. Curriculum Alignment

Ayşe, "...the sequence of topics already goes like this, first we teach proper fractions, then improper fractions, and finally mixed-number fractions, so it is appropriate for the goal and learning outcomes..."

Nehir, "Proper fractions and improper fractions are already 4th-grade topics, ...they are very suitable for the curriculum. ...I can have the children play these games constantly."

4.3.2. Attention-Grabbing Design

Ayşegül, "...learning about planets at first allows them to acquire knowledge about planets independently of mathematics... and this captures their attention... they feel the need to learn proper fractions, improper fractions, and mixed-number fractions with the motivation to succeed in the game."

Ali, "The games are engaging; space already attracts children's attention, and planets, stars, and spaceships are great, so students will have an enjoyable learning experience while playing."

4.3.3. Reinforcement-Oriented Design

Lale, "...it can be implemented during the teaching phase; however, as a game, it can be much better in the reinforcement phase."

Ela, "...in terms of reinforcement, it's not because it doesn't introduce new information. Students without prior knowledge of the subject won't know proper fractions, but for reinforcement, the game is appropriate."

4.3.4. Motivational Value

Ahmet, "...it's a game to be played calmly, while the second one demands increased speed, so players can recognise their progress as the difficulty increases... There are motivational words even in the messages at the end, particularly when students are unsuccessful, which I think is a very positive feature..."

Ayşe, "... Motivational words are included in the end-of-game messages when you can't succeed in it, which I think is very nice, and I think it's quite appropriate for maintaining the integrity of games."

4.3.5. Clear Explanations

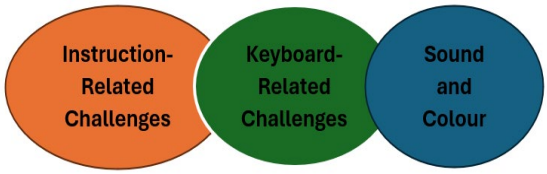
Veli, "I think it's understandable because the instructions are always like that, that is, you'll start now, you have 30 seconds, you'll get points for each one, you need to reach 6 points, etc. The instructions were clear, that is, they were nice."

Hasan, "The instructions in the games were clear and concise; they were very understandable and easy from the students' perspective."

4.4. Challenges Encountered in the Game

Participants reported that specific challenges in the designed game stemmed from the avatar's instructions during gameplay and from keyboard usage. Additionally, some participants identified sound and colour effects as sources of difficulty. Three sub-themes were identified: Instruction-Related Challenges, Keyboard-Related Challenges, and Sound and Colour Effects (Figure-10).

Figure 10 ***The Theme of Challenges Encountered in the Game and Sub-Themes***



4.4.1. Instruction-Related Challenges

Mehmet, "...the instructions appeared too quickly in the second game, whereas they were more appropriately paced in the first game..."

Ayşe, "I only missed the instructions, I mean, if there were verbal instructions... it would be more suitable for elementary school students, and when I missed the instructions, I missed parts of the game."

4.4.2. Keyboard-Related Challenges

Veli, "The first game... was somewhat difficult because we played with the keyboard, but using the mouse made gameplay a bit easier... it might be a little difficult for younger children. It could be easier if we play with the mouse, but a 4th-grade student could play it more comfortably..."

Elif, "...we press the space bar to move...but we press the arrows for direction in normal digital games, in online games, a single key is used to both change the direction and move forward ... I got a little confused about that..."

4.4.3. Sound and Colour Effects

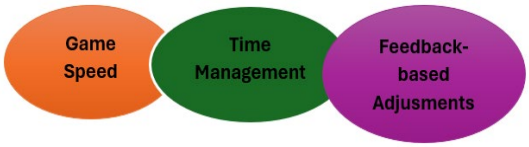
Ahmet, "...the background colours in the balloon game were overly bright and complex...the background was too striking, too colourful, I think it could be a little simpler... it might be more appropriate if the colours were a little closer to reality."

Elif, "...there was only an auditory signal to indicate incorrect answers; we could support that signal with a visual indicator, such as a cross; it could give a warning for incorrect answers."

4.5. Feedback on Design

Regarding the researcher's game design, participants primarily evaluated the speed of the games. They also offered various suggestions concerning time management and the sizes of the shapes used in the game. Four sub-themes were identified: Game Speed, Time Management, Shape Size, and Feedback-Based Adjustments (Figure-11).

Figure 11 ***The Theme of Design Feedback and Sub-Themes***



4.5.1. Game Speed

Mehmet, "Initially, the instructions in the second game progressed quickly, actually, however, the first game was a bit more suitable for the game features..."

Kaan, "...the game featuring stars could have exhibited a more fluid progression, and the spacecraft could move at a consistent speed... The speed could have been made adjustable, for example, we could have placed a speed variable on the interface, 0.5, 1, 1.5, etc., allowing for automatic adjustment..."

4.5.2. Time Management

Ayşegül, "...the allotted time in the second and third games could have been extended. Children get used to the game within 30 seconds, and the time expires. The duration could have been extended in the balloon game."

Mehmet, "...In the first game, the time was a bit limited; in my opinion, there were too many fractions presented for the available time... For elementary school students, the first game might be too brief, whereas the second game was appropriate in terms of timing."

4.5.3. Shape Size

Nehir, "The background in the space game was very nice; however, the planets were a bit small... It would be better if they were a bit bigger. The spaceship could also be bigger and have a different shape... it could be more colourful and eye-catching because I had difficulty seeing it initially."

Zeynep, "...I thought what if the spaceship could be a little smaller... The space between stars could be increased, or the spaceship could be smaller... the image of the planets could be enlarged."

4.5.4. Feedback-Based Adjustments

Fatma, "...the balloons might not have come one after another, that is, they appeared to overlap, making the fractions on the back balloon difficult to see... the characters and avatars were eye-catching and appealing to students. Could a human have been used instead of an avatar?..."

Ali, "In the space game, when you add proper fractions, your score increases, and then identifying improper fractions within the same game would further increase points, so the one with the highest score would win, fostering competition among students."

5. Discussion and Conclusion

The research findings indicate that prospective teachers regard educational digital games as effective tools for supporting student learning by making lessons enjoyable, capturing attention, enhancing motivation, and reinforcing acquired knowledge. In mathematics instruction, such games contribute to lesson enjoyment and concreteness, facilitate comprehension of abstract concepts, and promote long-term retention. Participants reported that the game aligned with the curriculum, featured attention-grabbing themes, and had clear, simple narration. However, certain aspects, including the speed of the game instructions, keyboard use, and sound and colour effects, posed challenges. These results indicate that educational digital games have significant potential to enhance student motivation and learning processes in mathematics instruction.

In the 21st century, children's play culture is changing in response to a world that is developing and evolving. Along with the changing play culture, digital games have become increasingly prominent in children's lives. This has attracted educators' attention, prompting them to seek ways to use digital games in education and leading to the emergence of the concept of "Educational Digital Games" (EDG). According to the results of this research, participants differentiated between EDG and digital games when defining EDG. They stated that digital games are non-educational, intended for entertainment and leisure, and can have negative consequences, while defining EDGs as educational, development-oriented games that reinforce lessons and positively influence students. The effect of a gamified educational application on a group of students is closely linked to the enjoyment experienced during gameplay (Ar and Akgün, 2014).

The study found that prospective primary school teachers believe that using EDGs in mathematics instruction would make lessons more enjoyable and concrete, thereby increasing their effectiveness and supporting long-term retention. These findings suggest that knowledge acquired in EDG-supported lessons can be retained and that EDGs can play a significant role in facilitating permanent learning (İlkay & Atik, 2024). Edusei (2022) also notes that when students regard learning mathematics as enjoyable and engaging, they are more likely to develop positive attitudes towards mathematics. The findings from this research are consistent with previous research (Aydın & Ata, 2024; Öztop, 2022; Yıldız, Tarım & Aktaş, 2024; Yong et al., 2021; Zabala-Vargas et al., 2022).

In the digital age, teaching materials that facilitate concretisation are evolving and increasingly being replaced by digital teaching tools. Contemporary students are immersed in the digital world and its technologies; considering their interests when structuring and concretising lessons will facilitate learning. Therefore, the undergraduate education of prospective primary school teachers is critically important. Indeed, to use a game effectively as a teaching tool in the classroom, teachers need to align it with the curriculum and plan the entire lesson accordingly (Tokarieva, 2019). In conclusion, educational programs must keep pace with digitalisation and be enriched with content that supports the use of technological tools (Alagöz, 2023).

Participants in this study generally reported that the EDG design was compatible with the curriculum, enriched with attention-grabbing elements, understandable and straightforward, effective in increasing student motivation, and focused on reinforcement. Participants' statements that the simple and clear structure of the games increased motivation align with studies emphasising that motivational elements are decisive in game design (Malone & Lepper, 1987; Hamari et al., 2016). From this perspective, these findings show that game-based designs encourage students to play a more active role in the learning process. Öztürk (2019) also emphasised that content that provides opportunities for visualisation, practice, and reinforcement contributes more to student learning.

Motivation is a crucial component of the learning process. Highly motivated individuals are more willing and diligent in comprehending information. As a result, motivated individuals tend to enjoy their learning experiences. İşçi's (2020) research findings indicate that prospective teachers believed that educational digital games make education more enjoyable, increase students' motivation and interest in school, support the teaching of complex subjects, and improve students' academic achievement. One way to ensure motivation is to integrate elements that students use and enjoy in their daily lives into lessons.

In our study, some prospective classroom teachers found that the instructions in the balloon game progressed quickly, while those in the space game were slower and more appropriate. Difficulties experienced by prospective teachers in using the keyboard indicate that technical skills are also essential for implementing the designed game. In conclusion, sound and colour effects are critical for enhancing the pedagogical impact of EDGs and supporting in-game interaction.

Based on feedback, the duration of the designed space game could be increased to 90 seconds, and the balloon-popping game to 60 seconds. EDGs can accelerate learning processes. They allow students to receive instant feedback, thus speeding up the learning process. Technology will be most effective when integrated into classroom applications, rather than replacing teachers. In conclusion, educators should consider incorporating gamified instruction into coding education while taking students' individual needs and preferences into account (Taş et al., 2023).

The Scratch program, used by the researcher in game design, has also been utilised in previous studies and has contributed to the design and application of EDGs. Turan's study (2022) highlighted the importance of adapting the block-based programming tool Scratch for planning mathematics lesson outcomes. According to research by Pilon & Ruales (2024), teacher-made digital games significantly improved students' academic performance in 3rd-grade Mathematics.

5.1. Limitations and Future Directions

Based on the findings of this research, it is recommended that educational digital games that facilitate the concretisation of concepts and increase student interest should be systematically incorporated into primary school mathematics lesson plans. In undergraduate programs, modules can be implemented to develop prospective primary school teachers' competencies in designing digital games aligned with pedagogical objectives, and the effectiveness of these games can be measured through experimental research. Sample scenarios, instructional guides, and materials can be prepared to help teachers select and implement appropriate games for their lessons.

Given students' individual differences, different speed and level options can be offered in the games, and the impact of these variables on learning outcomes can be investigated experimentally. Finally, the effectiveness of themes that increase student interest and achievement-oriented content in mathematics lessons can be examined comparatively across different grade levels and subjects to determine which types of games and themes are more effective in concept teaching.

6. Declarations

6.1. Author Contributions (CRediT)

Author 1 (Mustafa Mızrak): Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization.

Author 2 (Name Surname): Conceptualization; Methodology; Investigation; Writing—review & editing.

6.2. Conflict of Interest

The authors declare that they have no known competing financial interests, institutional affiliations, or personal relationships that could have appeared to influence the work reported in this paper.

6.3. Funding Statement

This research received no external funding. Where applicable, the funder(s) had no role in the study design; data collection, analysis, or interpretation; manuscript preparation; or the decision to publish the results.

6.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

6.5. Ethics Approval

This study was approved by the Pamukkale University Social and Humanities Research and Publication Ethics Committee (Approval No: E-93803232-622.02-449302; Approval Date: 06.11.2023). It has been determined that the research application demonstrates appropriate scientific conduct with respect to procedures and ethics. Informed consent was obtained from all participants prior to data collection.

6.6. Use of Artificial Intelligence (AI) Tools

After using this tool/service, we reviewed and edited the content as needed and take full responsibility for the publication's content.

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Enhancing direct instruction through an adapted K-W-L strategy

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ABSTRACT

Observations of pre-service teachers (PSTs) conducting Direct Instruction (DI) lessons reveal low levels of learner engagement, with instruction remaining predominantly teacher-centred. This conceptual pedagogical paper proposes a modification of Ogle's (1986) Know-Want-Learned (K-W-L) strategy, reformulated as K-W-L in Direct Instruction (K-W-L in DI). This is intended to help PSTs bolster learner engagement and implement inclusive teaching practices when using DI as a teaching strategy. Incorporating the K-W-L framework into DI activates learners' prior knowledge, promotes alignment with the lesson objective through structured teacher questions, and provides means for reflective learning through formative assessment. The K-W-L strategy in the DI framework can support differentiated instruction and scaffold learning within Vygotsky's Zone of Proximal Development. Although numerous adaptations of the original K-W-L strategy have been applied across disciplines to improve comprehension of expository texts, K-W-L in DI uniquely positions the K-W-L chart as an instructional tool within direct teaching. The three sections of the K-W-L chart facilitate the organisation of lessons into three phases: before, during, and post-engagement with new material. These three sections align, respectively, with the introduction, development (body), and consolidation stages of a DI lesson. This alignment enables the K-W-L chart to function as a structured scaffold for guided learning when utilising the DI teaching strategy. The proposed framework embeds teacher-generated questions, grounded in Bloom's revised taxonomy, to facilitate differentiated instruction and sustained learner participation throughout the lesson. This study underscores the value of preparing future teachers to use K-W-L in DI as both a planning and instructional medium to improve student engagement and inclusive teaching practices when presenting DI lessons.

KEYWORDS: Learner participation; Pre-service teachers; Work-integrated learning

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1. Introduction and Background

Globally, initial teacher education programmes expect PSTs to engage in work-integrated learning (WIL) or teaching practice, by presenting lessons in authentic school contexts for a period of time (Chou, 2019). In South Africa, WIL is a compulsory component of initial teacher education programmes (Department of Higher Education and Training, 2015), in which PSTs deliver lessons in schools. Pre-service teachers are guided to facilitate lessons using various teaching strategies, including direct instruction (DI). In the context of this paper, DI is regarded as a teacher-led strategy for sharing new information on a particular topic within a subject when teaching a group of learners.

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In our feedback sessions as teacher educators about PSTs' implementation of DI, three main areas of concern emerged. The first concern is that most DI lessons are presented in a lecture format, in which learners are mainly passive, except when answering questions posed by the teacher. The second concern is that the use of teaching media is often limited or absent. Teaching media refers to any material, such as pictures, objects, video clips, or graphic organisers, used during lesson facilitation to attract learners' attention and curiosity to learn, and to support their comprehension of information presented to them or with which they interact (Ordu, 2021). Teaching media, whether the latest technological advances or handmade media, should serve to support learners' learning. Thirdly, there is a concern that many PSTs do not account for learner diversity when planning lessons. These pitfalls remain, even though they are regularly addressed with PSTs. There is a need to develop ways for PSTs to enhance learner engagement, incorporate teaching media, and consider learner diversity when utilising DI.

This conceptual pedagogical paper proposes an adaptation to Ogle's (1986) K-W-L reading strategy. This K-W-L variant proposes using Ogle's (1986) K-W-L framework when presenting lessons that employ the direct instruction teaching strategy. Thus, this variation is called K-W-L in Direct Instruction (K-W-L in DI). The aim of the paper is thus to suggest how PSTs can employ the K-W-L strategy in DI during WIL to facilitate active learner engagement, scaffold learning, and develop critical thinking when presenting DI-based lessons. This raises the question: How can the K-W-L in DI enhance learner participation, provide learning support, and develop learners' critical thinking skills when PSTs deliver DI lessons during WIL?

The theoretical framing of the paper is followed by an explanation of Ogle's K-W-L (1986) as a reading strategy. The criteria for employing direct instruction are elucidated. A description of the newly proposed K-W-L in DI is provided. This is followed by a discussion of the correlation among the K-W-L in DI, the phases of a DI lesson, and the theoretical framework that augments learner engagement, contributes to learners' critical thinking, and serves as a form of learning support.

2. Theoretical Framework

A constructivist philosophy underpins the approach to teaching and learning in South African learning institutions. Therefore, Vygotsky's socio-constructivist theory is used to frame this paper.

The constructivist philosophy advocates a classroom environment where learners utilise and adapt (where necessary) their prior knowledge to construct new knowledge (Schur & Guberman, 2024). Teachers do not merely transmit information to learners, but support learners to "form conceptualisations that fit accepted knowledge within their culture", through their engagement in class activities (Jaworski, 1994; Schur & Guberman, 2024: 46). Learners actively co-construct their understanding and knowledge through active participation in the teaching and learning process (Adams, 2006; Jaworski, 1994; Killen & Hattingh, 2022). Learners' active participation in lessons is imperative within a constructivist-guided classroom. Teachers can use learners' responses to adapt their support and guidance (Jaworski, 1994).

It is vital to implement teaching strategies that scaffold learning, where the teacher and learners are active co-participants in the teaching and learning process (Agustin, Wahyudin & Isnaini, 2021; Guthrie, Wigfield & Perencevich, 2004). According to Mahan (2022), there are different conceptualisations of scaffolding. In this paper, scaffolding is linked to Vygotsky's zone of proximal development (ZPD), where learning support is provided by the teacher or a more knowledgeable other to assist learners in building comprehension of information or in performing a skill. Miller (2011:121) points out that "The distinctive feature of school learning and the zone of proximal development is

that the child receives instruction in what he cannot yet do, and this is the defining feature of the relationship between instruction and development." The implication is that the additional support, provided through social interaction and communication between the teacher and learner(s), enables learners to achieve at a higher level (Jaworski, 1994). Scaffolding within the ZPD serves as a form of learning support for learners (Shvarts & Bakker, 2019).

Scaffolding thus contributes to teachers' accommodation of learners' diverse learning styles and needs within the teaching and learning context. It supports inclusive teaching practices. Inclusive teaching practices should be infused into classroom teaching and not regarded as additional special-needs teaching sessions for learners experiencing barriers to learning. All teaching should be inclusive and support and encourage all learners to participate in, and learn from, the teaching and learning process. The teacher's support should, over time, benefit learners' cognitive development and independent learning.

Learning through a constructivist lens involves focusing on thought processes and respecting alternative interpretations, while encouraging critical thinking through stimulating questions (Adams, 2006). Constructivism requires a classroom that encourages learning through learner-learner and learner-teacher interactions that respect and explore thought processes (Adams, 2006).

3. Literature Review

3.1. The Original K-W-L Strategy

Donna Ogle (1986) designed the Know, Want, Learned (K-W-L) strategy to activate learners' prior knowledge, establish a reading purpose, and assess learning of expository text. Ogle (1986) describes the K-W-L as a versatile reading strategy that stimulates learners' thinking before, during, and after reading. Figure 1 provides an example of a K-W-L chart used by learners to read an expository text to learn about 'The Nile River'. A description of the original use of the K-W-L as a reading strategy then follows.

Figure 1 ***The K-W-L chart when using the K-W-L reading strategy***

Topic: Ancient Egypt: The Nile

Lesson Objective: At the end of the lesson, learners should be able to utilise the K-W-L strategy to read an expository text about the Nile River, and provide written answers to learner-generated questions.

K (what I KNOW)	W (what I WANT to know)	L (what I LEARNED)
Learners list keywords related to what they know about the topic.	Learners set their own questions related to what they would like to learn about the Nile River	Learners write the answers to the questions listed in W-column.
pyramids		
North Africa		
desert		
Nile (longest)		
pharaohs		
hieroglyphics		

sphinx

The three-columned K-W-L chart encourages learners to: recall prior knowledge by declaring what they already 'Know' in the K-column, write down self-generated questions to clarify what they 'Want' to know in the W-column, and indicate what they have 'Learned' by recording their answers in the L-column (Ogle, 1986).

The K-column is designed to activate learners' prior knowledge on a specific topic (Ogle, 1986). This allows the teacher to formatively assess learners' prior knowledge of the topic and clarify any misconceptions (Ogle, 1986). Learners are then encouraged, through modelling, scaffolding, and discussion, to categorise the keywords in the K-column. Figure 2 presents an example of categories created from the keywords in the K-column, related to the topic 'Ancient Egypt: The Nile'.

Figure 2 ***Categories derived from the K-column***

Categories derived from K-column		
Civilization and Society	**Monument / Structures**	**Geography**
• pharaohs	• pyramid • sphinx • hieroglyphics	• North Africa • Nile River • Desert

Learners move on to the second column (W-column). They record their questions about what they would like to learn about the Nile River. Learner-generated questions set a purpose and motivation for reading (Ogle, 1986).

Learners read the text on the Nile River and record the answers to their questions in the L-column to record what they have learned. The L-column plays a crucial role in informal formative assessment to address any learner misconceptions (Cantrell, Fusaro & Dougherty, 2000). Thus, the L-column offers a summary of the learner's learning. It helps showcase the interplay between existing and fresh insights, fostering deeper understanding and enhancing cognitive engagement. Questions not addressed in the text create the opportunity for learners to extend their inquiry through self-directed learning.

The K-W-L has proven versatile and effective across diverse educational settings, leading to enhanced comprehension, motivation, and metacognitive awareness (Ogle, 1986). A qualitative study conducted in Palembang, Indonesia by Fitriani, Tahrun, and Firdaus (2025) concurs that the K-W-L strategy results in significant improvements in reading comprehension, learner participation, and motivation.

The K-column places learners at the centre of the crucial initial step in learning: activating their prior knowledge. Active learner engagement and motivation are fostered when learners record their self-generated questions in the L-Column. Learner awareness of what they have learned is the focus of the L-column. Questions that the reading text does not answer provide an opportunity for learners to engage in extended self-directed learning. Throughout the use of the K-W-L, the teacher is present to guide and support learners in their learning. Thus, Ogle's (1986) K-W-L strategy is framed within the social constructivist perspective as it is learner-centred, provides for scaffolding (an inclusive teaching practice) within the ZPD, and stimulates learners' critical thinking through learner-generated

questions. There have, however, been adaptations to the original K-W-L (Ogle, 1986), to suit differing contexts.

3.2. Variants of the K-W-L

Carr and Ogle (1997) add mind-mapping to the K-W-L to support high school learners' comprehension of expository texts. This adaptation, named the K-W-L Plus, encourages keywords from the L-column to be plotted on a mind-map. Sippola (1995) added an S-column for learners to indicate what they still need to learn. The K-W-L-S was found to encourage primary school learners to pursue self-inquiry (Sippola, 1995). In Serbia, Bogdanović, Stanisavljević, Rodić, Rončević and Zouhor (2022) used a modified K-W-L, the TQHL (Think, Question, How, Learn) chart to teach physics to Grade 6 learners. Their findings indicate increased learner metacognition, which promoted scientific inquiry and self-regulation among learners (Bogdanović et al., 2022).

Research on the K-W-L and its variants has not been limited to samples of school learners. Studies involving English as a Foreign Language (EFL) university students in Indonesia reported improved comprehension and reading attitudes when combining K-W-L with peer tutoring (Rahmasari, Munir, & Nugroho, 2024). Diasti, Murniati, and Hartono (2023) reported improvements in university students setting reading goals and monitoring their comprehension and learning. Furthermore, a mixed-methods investigation on the pedagogical use of K-W-L charts involving teachers, PSTs, and nine- to eleven-year-old learners, was conducted in Northern Ireland (Greenwood, 2018). The research revealed that the strategy enhanced learner engagement, motivation, interest, and enjoyment, and also created a sense of ownership over learning (Greenwood, 2018). These studies feature K-W-L and its variants as tools for enhancing learner participation, developing comprehension skills, and metacognition across various academic levels and content areas.

This article proposes another variant of Ogle's (1986) K-W-L, namely, the K-W-L in Direct Instruction (K-W-L in DI). K-W-L in DI suggests a way to minimise challenges that PSTs typically encounter when implementing DI during WIL. An overview of DI is followed by an explanation of the proposed K-W-L in DI.

3.3. Direct Instruction

Direct instruction (DI) is described as explicit, teacher-directed "expository teaching" in which the teacher presents information to learners (Rosenshine, 2012: 1; Killen & Hattingh, 2022: 138; Shammas, 2023). Rosenshine (2012) warns, however, that the term Direct Instruction should be carefully clarified to avoid confusion. Rosenshine (2012: 1) identifies the following five descriptions of DI:

1. Academic instruction that is led by a teacher, regardless of the quality of instruction.
2. The instructional procedures used by effective teachers in the teacher effects research.
3. Instructional procedures used by teachers when they teach cognitive strategies to students.
4. Instructional procedures used in the Distar (Direct Instruction Systems in Arithmetic and Reading programs).
5. Instruction portrayed in negative terms, such as settings where the teacher lectures and the students sit passively.

Typically, PSTs from the author's institution prepare DI lessons by selecting lesson content, setting lesson objective(s), deciding on lesson pacing, leading explanations, and determining the concluding informal assessment activity for learners to complete. Description five (5) above by Rosenshine

(2012: 1) relates to the observations noted when PSTs (from the institution where the author works) present DI-based lessons during WIL. Some disadvantages are associated with DI.

3.3.1. Disadvantages of DI

Traditionally, DI is associated with a transmission model of teaching, in which information flows from the teacher to learners and learners are positioned as passive recipients of information (Dubinsky & Hamid, 2024). A negative connotation is associated with DI where "... the teacher lectures and students sit passively" (Rosenshine, 2012: 1). Learners become disinterested and bored if they are not actively involved in the lesson in some way (Killen & Hattingh, 2022; Rosenshine, 2012).

Another negative is that DI relies heavily on learners listening to the teacher's explanations, narration, or descriptions, thereby favouring learners with a predominantly auditory learning style. It is imperative for teachers to engage all learners in the lesson as much as possible by catering to visual, kinesthetic, and tactile learners.

Another concern that arises is the possibility that only the teacher's perspective is presented to learners (Killen & Hattingh, 2022). Teachers should provide time for learners to ask questions and share their viewpoints during DI lessons.

Teacher-led questioning generally dominates direct instruction lessons. Effective questioning by the teacher can contribute to learner engagement and serve to monitor learners' understanding of the content presented. However, learner-generated questioning should be encouraged during DI. When learners are encouraged to regularly construct their own questions on the topic, their critical thinking skills are developed (Spencer, Causey, Ernest, & Barnes, 2020). Despite some negative aspects being associated with DI, it is an appropriate teaching strategy under particular circumstances.

3.3.2. Advantages of DI

DI can be effective when the teacher seeks to activate learners' prior knowledge and actively engages learners in the lesson (Killen & Hattingh, 2022). DI is appropriate when learners' attention needs to be focused on specific information that directly aligns with the lesson objective(s), when the content is new to learners, when learners possess limited prior knowledge on the topic, or when time constraints are evident (Killen & Hattingh, 2022; Orlich, Harder, Callahan, Trevisan & Brown, 2010). Time constraints are often a reality in the South African context. This is due to the amount of content indicated in the Annual Teaching Plans issued by the South African Department of Basic Education that teachers are under pressure to 'cover' (Bertram, Mthiyane & Naidoo, 2021: 1; Hoffman & Maarman, 2024).

Additional challenges impact teaching and learning in some South African schools. The challenges relate to overcrowded classrooms, insufficient resources (including textbooks, for example), a lack of Information and Communication Technology (ICT), limited facilities like libraries and/or science laboratories, and absent or intermittent electricity supply (Mokgwathi, Graham & de Villiers, 2023; West & Meier, 2020). Teachers might find it best to employ DI when considering these potential extrinsic barriers to teaching and learning.

The use of DI ensures that all learners in class are exposed to the same content. The strategy is suitable for teaching diverse learners as well as large and small class sizes. Additionally, the strategy is well-suited to support learners who find it challenging to read expository texts independently. An advantage of direct instruction is that the teacher can apply informal formative assessment and immediate feedback to learners throughout the lesson. Misconceptions or misunderstandings can be minimised in this way.

The proposed use of an adapted K-W-L in conjunction with DI appears to present a theoretical contradiction. The way in which the proposed K-W-L in DI mitigates this contradiction is provided after the explanation of the K-W-L in DI.

4. K-W-L in Direct Instruction (K-W-L in DI)

The use of an adapted K-W-L is presented, taking into account previously noted contextual factors such as inadequate resources, overcrowded classrooms, and intermittent electricity supply in some South African schools. The K-W-L in DI, used in the context of a DI-based history lesson on the topic of "Egypt: The Nile River," is illustrated in Figure 3. In this example, the K-W-L in the DI chart serves as a framework for learners to recall prior knowledge (K-column), use teacher-generated questions set across the cognitive levels of Bloom's taxonomy to establish the goal for listening to information (W-column), and consolidate and summarize information (L-column).

Figure 3 ***The K-W-L in the DI chart***

Topic: Ancient Egypt: The Nile

Lesson Objective: At the end of the lesson, learners should be able to complete a K-W-L chart by writing the keywords that can be used to answer questions on to the Nile River.

LESSON INTRODUCTION	BODY OF LESSON	LESSON CONCLUSION
K (what I KNOW) (Keywords from learners)	**W (what I WANT to know) Teacher-/learner-generated questions**	**L (what I LEARNED) (Answers - keywords)**
pyramids North Africa desert Nile (longest) pharaohs hieroglyphics sphinx	1.	Lake Victoria, Uganda
	2.	Fertile soil, crops, food
	3.	Water - crops, animals, cleaning, cooking, fishing, sailing, transportation
	4.	Farming - water, crops, fish, survive) Transport - materials, build, trade
	5.	Water – life
	6.	Settlement, water – food, trade, transport, pyramids, temples, cruises, tourism
	OWN QUESTIONS	

4.1. Teaching Media

In school contexts with limited or absent resources, such as data projectors, electronic white boards, or electricity supply, teachers can create their own teaching media (teaching aids). Figure 4 shows an example of a partially completed K-W-L chart, word cards, and sentence strips created by a teacher. It is used in conjunction with an appropriate visual stimulus on the topic – in this example, an image

of the pyramids and Sphinx (Figure 5) to introduce the lesson on 'Ancient Egypt'. The K-W-L in DI chart, word cards, sentence strips, and pictures serve as teaching media in the absence of technology, such as a data projector or interruptions to the electricity supply.

The teacher predicts the answers (prior knowledge) that learners are likely to provide and prepares relevant keywords as word cards when preparing the lesson. The word cards can serve as teaching media to draw learners' attention to keywords (prior knowledge) and to display it. The word cards save time as the teacher does not need to write each keyword under the K-column. However, unforeseen keywords provided by learners can be written in the K-column. Learners see and hear the keywords, thereby accommodating both auditory and visual learning modalities.

The question strips are tangible paper strips on which the pre-planned teacher-generated questions are recorded. These question strips help draw learners' attention to each question and, thus, serve as a form of teaching media.

Figure 4 *The K-W-L in DI chart with word cards and question strips*

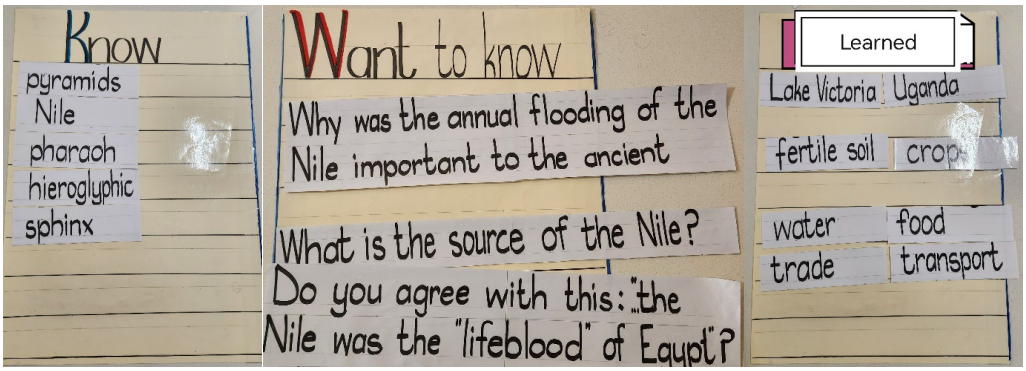


Figure 5 *Image of pyramids and Sphinx*

4.2. The Introduction and K-Column

When introducing the lesson, the teacher draws learners' attention to a picture of the pyramids and the Sphinx at Giza (Figure 5). The teacher prompts learners to recall and articulate their prior knowledge of the topic, recording and displaying their answers in keyword format in the K-column (Figures 3 and 4). (Examples of alternatives to the picture as teaching media are a short video clip, an auditory snippet, or objects associated with Egypt).

During the introduction, the K-column enables teachers to activate learners' prior knowledge (Ogle, 1986), capture learners' attention, stimulate curiosity, and link to the lesson objective(s). The opportunity for formative assessment and scaffolding within the classroom is created (Jaworski, 1994; Schur & Guberman, 2024).

4.3. The Body of the Lesson and the W-Column

The teacher-selected content aligned to the lesson objective(s) is presented to learners during the body of the DI-based lesson. The traditional transmission model of DI often frames the teacher as the information transmitter, with learners as passive recipients. In the K-W-L in DI, teacher-generated questions are displayed in the W-column. The use of teacher-generated questions in the K-W-L in DI deviates from Ogle's (1986) K-W-L. In Ogle's (1986) K-W-L, learners generate questions before they read expository text. Learners' generation of questions is an important aspect of learning. For this reason, the K-W-L in DI includes a space for learners to add their own questions to the W-column. Table 1 depicts the teacher-generated questions, set across the cognitive levels of Bloom's taxonomy, to be placed in the W-column of the K-W-L in DI chart (Figure 3).

Table 1 ***The W-column of the K-W-L in DI chart***

BODY OF LESSON
W (WANT to know) - Teacher-generated questions [Bloom's taxonomy]
1. Where does the Nile River originate (start, source)?
2. Why was the annual flooding of the Nile River important to ancient Egyptians?
3. If you were an ancient Egyptian farmer, how would you use the Nile River in your daily life?
4. What are two different ways the Nile River helped ancient Egyptians, and how are they related?
5. Do you agree with the statement that the Nile was the "lifeblood" of Egypt? Why or why not?
6. Design a travel brochure that highlights the historical and modern importance of the Nile River. What key features would you include?
OWN QUESTIONS (Learner-generated questions)

The teacher-generated questions placed in the W-column (Figure 3 and Table 1) align with the lesson objective. The questions can be structured from the lowest to highest cognitive levels according to Bloom's revised taxonomy, namely Remember, Understand, Apply, Analyse, Evaluate, and Create (Krathwohl, 2002). Addressing one question at a time helps break the material into sections (chunking), allowing time for explanations, questioning, clarification of misunderstandings, and for learners to ask questions.

Learners are encouraged to read the questions either individually, in pairs, or in small groups. Learners answer or attempt to answer each question. The teacher further elaborates on the learners' answers, using DI to provide information they might have missed. The answers are placed in the Learned column as keywords or phrases (Figure 4).

As with column-K, the answers can be pre-planned using word cards or phrase strips that are easy to display. Learners' attention is drawn to the next question in the W-column, and the process is

repeated. Teaching media, such as relevant pictures or short video clips, could accompany the explanations.

The W- and L-columns serve as vehicles for sequencing and presenting content in manageable sections. They guide comprehension through teacher- and learner-generated questions. Additionally, the questions prompt higher-order thinking when aligned with Bloom's revised taxonomy. In this phase, social constructivist principles become evident as learners engage in knowledge building within their ZPD, supported by teacher mediation and scaffolding (Shvarts & Bakker, 2019; Adams, 2006).

For greater alignment with constructivism, I suggest that the teacher employ Socratic questioning rather than directly explaining the information to learners. Utilising Socratic questioning can encourage critical thinking (Paul & Elder, 2008) among learners, prompting them to voice their views and thus enhancing learner dialogue and agency in the lesson.

The teacher encourages learners to formulate their own questions related to the topic, which are placed in the 'Own Questions' section (Figure 3 and Table 1). These are questions that might occur to learners during the lesson. Questions can be added to this section of the K-W-L in the DI chart during any phase of the lesson, although it is likely that learners will add questions while interacting between the K- and L-columns. Generating their own questions helps learners to develop their critical thinking and encourages their motivation to learn (Ness, 2015). Learner-generated questions might need additional research and time to address. Learners should be encouraged to participate in self-directed learning to discover the answers. It is important for the teacher to follow up on the unanswered questions in the next lesson.

Once the questions have been answered, the L-column serves as a summary of the lesson. The keywords can be reused during a revision session. One idea is to remove the keywords (word cards) from the L-column and randomly assign them to different learners. Learners answer the revision questions and place the appropriate word card in the L-column to reconstruct the summary. Another idea, based on the K-W-L Plus (Carr & Ogle, 1997), is to use keywords (word cards) to construct a tangible mind map as a lesson summary.

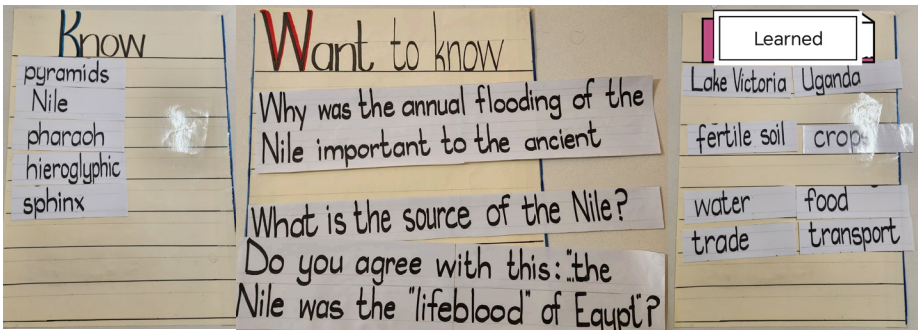
4.4. Balancing the Seeming Theoretical Contradiction

As stated previously, DI is traditionally associated with the transmission model of teaching, whereas the K-W-L strategy is framed within the transactional model and aligned to the social constructivist perspective (Dubinsky & Hamid, 2024; Killen & Hattingh, 2022; Rosenshine, 2012). The use of the transactional K-W-L within a transmission model, such as DI, appears contradictory. However, the seeming contradiction is mitigated when the adapted K-W-L framework is deliberately incorporated into DI.

While core features of DI, such as clear objectives, sequenced content, and explicit modelling, are retained, the K-W-L structure repositions learners as co-constructors of meaning rather than passive recipients of information. In this way, the K-W-L framework functions as a mediating tool that reshapes the DI teacher-centred strategy to reflect the interactive and participatory character of a constructivist classroom.

The K-W-L model in DI, as shown in Figure 6, illustrates how it can support the structured flow of a DI lesson while embedding social constructivist principles that foster learner engagement, critical thinking, and inclusive classroom practice.

Figure 6 ***Model of the K-W-L in DI***



In a typical teacher-centred DI introduction, the teacher announces the topic and objective, and perhaps asks a few recall questions, and then moves quickly into explaining the new content. With K-W-L in DI, the K-column serves to stimulate the constructivist process of activating, acknowledging, and purposefully using learners' prior knowledge as the starting point for new learning. Consequently, the initial "content" displayed (K-column) is generated by the learners themselves rather than by the teacher.

The teacher formatively assesses learners' prior knowledge and guides and scaffolds learning within the ZPD. The latter contributes to inclusive teaching practices. The introduction becomes an interactive process (learners speak, listen to one another, and negotiate meaning) in which learners see their contributions displayed on the chart. Thus, the introductory phase shifts from the teacher introducing the topic to the class surfacing what they already know, while the teacher refines it. DI remains teacher-led at the planning level, but epistemic authority is shared at the interactive classroom level because learners' prior knowledge shapes how the lesson unfolds.

Learner autonomy is likely to increase when K-W-L is implemented in DI. Learners experience themselves as contributors whose existing knowledge matters when the K-column is used to assess and foreground their prior knowledge as the legitimate starting point to lessons. Learners gain a sense of ownership of the content as they see their keywords and associations displayed in the K-column. They can monitor how their initial conceptions are confirmed, refined, or challenged during the lesson. Autonomy is further supported when the teacher explicitly invites multiple perspectives and treats divergences in prior knowledge as resources for inquiry, rather than errors to be eliminated.

In a conventional DI body of the lesson, the teacher presents content in chunks, asks mostly teacher-generated questions, while learners mainly answer or take notes. The K-W-L in the DI framework retains the idea of structured, sequenced input, but uses the W- and L-columns to build cyclical learner involvement around each content segment.

Teacher-generated questions are designed to align constructively with the lesson objective and Bloom's revised taxonomy. However, the teacher-generated questions create a shared roadmap toward the lesson objective. Socratic questioning has the potential to stimulate learners' inductive reasoning, scaffold the construction of their own understanding of the answers in the W-column, and enhance learner dialogue and agency.

Learners are encouraged to add their own questions. This implies that the informational agenda is partly co-constructed as learners' curiosities and uncertainties become legitimate drivers of the information to be addressed. Learner-generated questions, encouraged during the body and conclusion of the lesson and captured across the W- and L-columns, legitimise learners as questioners. It invites learners to interrogate information rather than accept it uncritically. As learners generate their own questions, they develop individual purposes for learning within the broader lesson

objective. This process of learners generating questions can support the development of critical thinking and a sense of ownership over the learning process, which further contributes to learner autonomy.

As learners and the teacher collaboratively articulate answers, the teacher captures these as concise keywords or phrases in the L-column. Learners are required to explain, justify, and refine their answers, making their reasoning visible and creating opportunities for peer contributions and debate. Learners are repeatedly positioned as thinkers or active meaning-makers, not passive recipients of content framed by the W-column (what we want to know) and the L-column (what we learned). The linear course of DI is broken into interactive cycles of prediction, explanation, questioning, and consolidation, which is consistent with socio-constructivist views of learning as socially mediated.

Throughout all phases, the K-W-L in DI structure facilitates ongoing formative assessment. In the introduction, the K-column makes learners' prior conceptions visible and allows misconceptions to be explored. Similarly, during the body and conclusion, the W- and L-columns provide repeated opportunities to check and refine understanding. In this way, K-W-L in DI supports scaffolding within learners' zones of proximal development.

The K-W-L in the DI framework can bolster inclusive teaching practices when used strategically. Teacher-generated questions in the W-column can be differentiated by deliberately aligning them with varying cognitive levels, for example, through Bloom's taxonomy, thereby catering to learners functioning at different levels of cognitive demand. Varying the modes through which learners respond (verbally, in writing, or via images and other representations) further extends opportunities for meaningful participation. At the same time, carefully designed higher-order questions and tasks can progressively expose and scaffold learners towards more complex thinking. In this way, K-W-L in DI reconciles a teacher-centred strategy (DI) with social constructivist principles, allowing for more equitable and differentiated participation in classroom learning.

The completed K-W-L chart, delivered verbally or as a learner-produced product, allows the teacher to assess learners' attainment of the lesson objective(s) formatively. Subsequently, it informs whether reteaching or learning support provision is required. The ideal is for learners to utilise the K-W-L in the DI framework to guide their independent learning. This would require their regular exposure to the K-W-L in the DI framework. The teacher gradually scaffolds learners to independently apply the K-W-L strategy within the DI framework to process and critically evaluate the information they encounter during DI lessons.

In summary, applying K-W-L in DI promotes constructivist processes such as drawing on learners' prior knowledge, encouraging learner-generated questions, and sharing the meaning-making process. K-W-L in DI invites learners into epistemic work traditionally dominated by the teacher, who shares reasoning, questioning, and monitoring of understanding. This shifts the lesson from a simple transmission model of 'telling' towards a more transactional model of joint enquiry and discovery.

5. Conclusion

The conceptual model of K-W-L in Direct Instruction contributes theoretically by reframing a traditionally teacher-centred strategy through a socio-constructivist lens. By aligning the K-, W-, and L-columns with the introduction, body, and conclusion of a DI lesson, the model demonstrates how learner participation, questioning, and metacognitive reflection can be embedded within a structured, objective-driven format. This positioning of the K-W-L in the DI chart as both an organisational tool and an interactional scaffold extends earlier work on K-W-L as a reading support strategy (such as (Ogle, 1986; Carr & Ogle, 1987) to the domain of whole-class teaching. The K-W-L in

DI offers a theoretically grounded mechanism for integrating scaffolding and support via the ZPD into DI without abandoning its core features.

The proposed model, however, has several limitations. It is presented as a conceptual and pedagogical framework rather than the outcome of empirical intervention research. As such, its effectiveness has not yet been systematically assessed across school phases, subjects, or institutional contexts. The discussion is situated within the South African teacher education context, with a focus on pre-service teachers' work-integrated learning. This may limit direct transferability to contexts with different curriculum demands, class sizes, or resource conditions. Furthermore, the model assumes that teachers possess sufficient questioning skills, content knowledge, and classroom management capacity to implement K-W-L in DI as intended. These assumptions require empirical scrutiny.

Despite these limitations, the K-W-L in the DI model has promising applications in practice and future research. In initial teacher education programmes, it can be used as a planning template and reflective tool to help pre-service teachers design DI lessons that incorporate teaching media, scaffolded questioning, and learner-generated contributions more systematically. In school settings, the model offers a feasible way to promote more inclusive, dialogic, and cognitively demanding classroom interaction in contexts where DI is prevalent due to curriculum pressures or resource constraints. Future empirical studies could examine how the model influences learner engagement, critical thinking, and achievement. Additionally, future research can explore how pre-service teachers, in-service teachers, and teacher educators appropriate and adapt the framework across subjects, phases, and universities.

6. Declarations

6.1. Author Contributions (CRediT)

Researchers' contribution rate statement: The authorship contribution for this paper is as follows: sole authorship (100%).

6.2. Conflict of Interest

The authors declare that there is no conflict of interest to disclose

6.3. Funding Statement

The authors declare that the study received no funding.

6.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

6.5. Ethics Approval

As a conceptual pedagogical paper, the approval by an ethics committee is not required.

6.6. Use of Artificial Intelligence (AI) Tools

During the preparation of this work, PerplexityPro was used to ascertain whether there was literature on PSTs' use of the K-W-L strategy to enhance DI-based lessons and to determine the extent of South African literature on its use in DI lessons. Writefull was used as a language editor. The free version of ChatGPT was used to cross-check whether the sources cited were present in the reference list and that sources in the reference list were cited in the text. After using the above-mentioned, I reviewed and edited the content as needed and take full responsibility for the publication's content.

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Early educational experiences and teacher gender bias in shaping female students' interest in Physics

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ABSTRACT

Gender disparities in physics persist globally, with female participation in STEM fields remaining disproportionately low in Ethiopia. Drawing on Situated Expectancy-Value Theory (SEVT) and Social Cognitive Theory (SCT) as interpretive frameworks, this study examined how early educational experiences, teacher influence, and gender bias shape female students' interest in physics in Kaffa Zone secondary schools in Southwest Ethiopia. A quantitative approach was employed to collect data from 352 female students using structured questionnaires. Exploratory factor analysis confirmed construct validity (KMO = 0.847), and reliability was excellent (α = 0.951). Early educational experiences and exposure to female role models emerged as the strongest predictors of interest in physics. From a SEVT perspective, these findings suggest that formative experiences shape students' expectations for success and subjective task value, while from an SCT perspective, they highlight the importance of mastery experiences and vicarious learning in developing self-efficacy. Curriculum approaches and sociocultural influences also contributed significantly. Notably, teacher influence and gender bias were not significant predictors, suggesting evolving teacher attitudes in this context. This study underscores the critical importance of early exposure to science, visible female role models, and inclusive curricula in fostering girls' interest in physics.

KEYWORDS: Gender disparity; Physics education; Female role models; Early educational experiences; Teacher influence and gender bias; SEVT; SCT; STEM; Ethiopia

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1. Introduction

Gender inequality in science, technology, engineering, and mathematics (STEM) education remains a persistent global challenge despite considerable progress in expanding access to education. Women and girls continue to be underrepresented across STEM fields, often constituting a third or less of participants in education, employment, and innovation sectors (UNESCO, 2017, 2024). Recent data indicate that while women earn a larger share of bachelor's degrees overall, their representation in STEM fields remains notably lower (National Center for Education Statistics [NCES], 2023). This pattern is reflected globally, with similar disparities observed across Canada, the United Kingdom, Japan, and other nations (World Economic Forum [WEF], 2024). This disparity is not attributable to differences in ability; rather, it reflects systemic barriers, gender stereotypes, and unequal educational experiences that begin early in life and extend across academic and professional trajectories. Physics, in particular, consistently exhibits among the most pronounced gender disparities across scientific disciplines (Murphy & Whitelegg, 2006; UNESCO, 2017).

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Studies have indicated that gender disparities in STEM participation often emerge during secondary education and persist into higher education and professional careers (Wang & Degol, 2017). Multiple factors contribute to the lower participation of female students in physics. These include gender stereotypes, societal expectations, classroom experiences, and limited exposure to female role models (Dasgupta & Stout, 2014). Recent research has further highlighted that subtle gender dynamics in educational settings, such as differential task allocation in laboratory activities and comfort levels with hands-on equipment, can significantly influence female students' engagement with physics (Paul, 2026; Paul et al., 2025). In introductory physics laboratories, while overall participation rates may appear gender-neutral, significant differences emerge in task preferences: male students show greater preference and comfort with hands-on equipment handling, while female students gravitate toward analytical and documentation tasks (Paul, 2026). These patterns, combined with qualitative reports of exclusion from group discussions and reluctance to contribute in male-dominated groups (Paul et al., 2025), suggest that classroom micro-interactions play a significant role in shaping female students' engagement.

From a theoretical perspective, situated expectancy-value theory (SEVT) posits that students' academic choices are influenced by their expectations for success and the subjective value they attach to tasks, both of which are shaped by social contexts, cultural norms, and prior experiences (Eccles & Wigfield, 2002, 2020). Complementarily, social cognitive theory (SCT) emphasizes the role of self-efficacy—individuals' beliefs in their capabilities to perform specific tasks—which is developed through mastery experiences, vicarious learning, social persuasion, and emotional states (Bandura, 1986). Together, these theories provide a comprehensive framework for understanding how contextual factors shape students' academic interests and career aspirations.

The role of teacher influence in shaping these experiences is critical. Teacher influence encompasses not only instructional practices but also subtle ways teachers communicate expectations, provide feedback, and interact with students. Research suggests that teachers may unconsciously hold gender stereotypes regarding students' abilities in science and mathematics (Lavy & Sand, 2018). Such gender bias may appear in subtle classroom practices, including differences in questioning patterns, feedback, and the allocation of learning opportunities (Sadker et al., 2010). These biases can influence students' confidence, participation, and, ultimately, their interest in physics.

However, recent cross-national research reveals a troubling paradox: despite formal commitments to equality, many STEM teachers demonstrate limited awareness of how stereotypes, social expectations, and systemic inequalities affect girls' participation, instead attributing underrepresentation to personal choice or aptitude (Monteiro et al., 2025). This perception–practice gap underscores the need for deeper pedagogical transformation in science education.

Another important factor influencing female participation in STEM is the availability of role models. Exposure to successful female scientists can encourage girls to pursue science-related careers and challenge stereotypes about gender and scientific ability (Dasgupta & Stout, 2014). Recent research has refined our understanding of role model effectiveness: perceiving academic similarity to role models, particularly in terms of effort and abilities, positively predicts students' motivation to pursue STEM careers (Chen et al., 2026). Furthermore, interventions using video presentations of female role models have shown promise in increasing young women's expected sense of belonging in engineering contexts (Giese et al., 2025).

In Ethiopia, despite national policies aimed at promoting gender equality in education, female enrolment in university-level physics programmes remains disproportionately low (Egne, 2014; Semela, 2010). Cultural expectations, limited exposure to female role models, and teacher influence

and gender bias that may not fully support female participation contribute to this imbalance. This study examines how early educational experiences, teacher influence, and gender bias shape female students' interest in physics in secondary schools in the Kaffa Zone of Southwest Ethiopia. Drawing on SEVT and SCT as interpretive frameworks, this study investigates the direct relationships between contextual factors and female students' engagement with physics.

1.1. Statement of the Problem

Despite global and national efforts to promote gender equality in education, female participation in physics and other STEM disciplines remains significantly lower than that of males. Research has shown that girls often demonstrate lower levels of interest and confidence in physics than boys, even when they have similar academic abilities (Wang & Degol, 2017). Recent studies have documented that while overall participation rates in physics laboratories may appear gender-neutral, significant disparities emerge in task preferences and comfort levels: male students tend to prefer and feel more comfortable with hands-on equipment handling and data collection, whereas female students more frequently prefer analytical and documentation tasks (Paul, 2026). Qualitative responses further reveal that some women experience exclusion from group discussions and reluctance to contribute ideas in male-dominated groups (Paul et al., 2025).

One explanation for these disparities is that students' interest in science subjects is shaped by a combination of educational experiences, social influences, and classroom practices. Early exposure to science learning activities can significantly influence students' motivation to pursue science-related fields (Hazari et al., 2010). Recent intervention research demonstrates that early STEM exposure through hands-on activities can significantly enhance girls' self-efficacy, interest, and career aspirations, while fostering a sense of belonging and willingness to challenge gender-based stereotypes (Miranda, 2025). Similarly, experimental studies with young children have shown that role-playing as scientists boosts girls' persistence in science activities (Huang et al., 2026).

Teachers also play a critical role in shaping students' learning experiences through their influence and potential gender bias (Lavy & Sand, 2018; Sadker et al., 2010). However, recent cross-national research reveals a troubling paradox: despite formal commitments to equality, many STEM teachers demonstrate limited awareness of how stereotypes, social expectations, and systemic inequalities affect girls' participation (Monteiro et al., 2025). In Ethiopia, although girls' participation in education has improved, female representation in STEM fields remains limited (Egne, 2014). Therefore, this study aims to investigate the role of early educational experiences, teacher influence, and gender bias in shaping female students' interest in physics in secondary schools in the Kaffa Zone, Southwest Ethiopia.

1.2. Research Questions

The study is guided by the following research questions:

1. How do early educational experiences influence female students' interest in physics?
2. To what extent do teachers influence, and gender bias (e.g., instructional methods, feedback, encouragement, and equitable treatment) affect female students' interest in physics?
3. How inclusive is the physics curriculum and teaching methods in addressing the needs of female students in Kaffa Zone secondary schools?
4. What impact do female role models in science have on shaping female students' interest in physics?

5. How do societal expectations and cultural norms influence female students' perceptions of physics and their engagement with the subject?
6. To what extent do early educational experiences, teacher influence, gender bias, curriculum approaches, role models, and sociocultural factors jointly predict female students' interest in physics?

1.3. Objectives of the Study

The general objective of this study was to investigate the role of early educational experiences, teacher influence, and gender bias in shaping female students' interest in physics in Kaffa Zone secondary schools in Southwest Ethiopia.

Specific objectives:

1. Examine the influence of early educational experiences on female students' interest in physics.
2. Analyze the impact of teacher influence and gender bias (including encouragement, feedback, equitable treatment, and classroom interactions) on female students' interest in physics.
3. Assess the inclusiveness of the physics curriculum and teaching methods regarding female students.
4. Influence of female role models in science on female students' interest in physics.
5. Analyze the impact of societal expectations and cultural norms on female students' interest and participation in physics.
6. Determine the combined effect of early educational experiences, teacher influence and gender bias, curriculum approaches, role models, and sociocultural factors on female students' interest in physics.

2. Literature Review

2.1. Theoretical Foundations: SEVT and SCT

Understanding female students' participation in physics requires a strong theoretical grounding in motivation and learning. This study draws on two complementary theoretical frameworks—Situated Expectancy-Value Theory (SEVT) and Social Cognitive Theory (SCT)—to interpret the relationships between contextual factors and female students' interest in physics.

Situated Expectancy-Value Theory (SEVT), as developed by Eccles and colleagues, posits that students' achievement-related choices are primarily determined by two key factors: their expectations for success and the subjective task value they attach to a domain (Eccles & Wigfield, 2002, 2020). Expectations for success refer to students' beliefs about their ability to succeed in a given task, while subjective task value comprises multiple components: intrinsic value (enjoyment of the task), utility value (perceived usefulness for future goals), attainment value (importance of doing well for one's identity), and cost (perceived barriers). Importantly, these motivational beliefs are not formed in isolation but are shaped by social contexts, cultural norms, and prior experiences (Eccles & Wigfield, 2020).

Social Cognitive Theory (SCT), proposed by Bandura (1986), emphasizes the role of self-efficacy—individuals' beliefs in their capabilities to successfully perform specific tasks—as a central mechanism in motivation and behavior. According to SCT, self-efficacy is developed through four primary sources: mastery experiences (past successes), vicarious learning (observing similar others

succeed), social persuasion (encouragement from others), and emotional and physiological states. In educational contexts, SCT highlights the importance of teacher influence as a source of social persuasion and modeling, and role models as sources of vicarious learning (Bandura, 1986).

Together, SEVT and SCT provide a comprehensive framework for understanding how contextual factors influence female students' interest in physics. This study uses these theories as interpretive frameworks to understand the direct relationships observed among early educational experiences, teacher influence, gender bias, role models, sociocultural influences, and female students' interest in physics.

2.2. Gender Disparities in STEM Education

The underrepresentation of women in STEM fields is a well-documented global phenomenon. Physics, in particular, exhibits one of the most pronounced gender gaps among scientific disciplines (Murphy & Whitelegg, 2006; UNESCO, 2017). Although women constitute a large proportion of students in general education, their representation declines significantly in advanced science fields, a phenomenon commonly described as the "leaky pipeline" (Blickenstaff, 2005). Recent data confirm that this pattern persists globally, with women earning only 38% of STEM bachelor's degrees despite constituting 58% of all degree recipients (NCES, 2023; WEF, 2024).

This pattern often begins during the early stages of schooling, where social stereotypes, cultural expectations, and unequal educational experiences influence students' perceptions of science (Hazari et al., 2010). By age six, children already associate science with men and are more likely to draw men than women when asked to draw a scientist (Miller et al., 2018). Around the same age, girls become less likely than boys to express interest in activities described as being for "really, really smart" children (Bian et al., 2017). Recent laboratory-based research has uncovered subtle gender dynamics that may contribute to these disparities (Paul, 2026; Paul et al., 2025).

2.3. Influence of Early Educational Experiences

Early educational experiences play a critical role in shaping students' attitudes toward science and their future academic choices. Research has shown that early exposure to science through hands-on activities, teacher encouragement, and participation in science-related activities significantly increases students' likelihood of pursuing STEM fields (Tenenbaum & Leaper, 2003). Recent intervention studies have provided compelling evidence for the effectiveness of early STEM exposure. Miranda (2025) examined the impact of a hands-on STEM program for fifth-grade girls and found significant enhancements in participants' interest, self-efficacy, and career aspirations, as well as an increased sense of belonging and willingness to challenge gender-based stereotypes. Experimental research with young children has demonstrated that even brief interventions, such as pretending to be a scientist during a science activity, can boost girls' persistence in science tasks (Huang et al., 2026).

From an SEVT perspective, early educational experiences contribute to the development of both expectancy beliefs and task value. When female students have positive experiences with science in primary school, they are more likely to develop higher expectations for success and greater intrinsic and utility value for physics (Eccles & Wigfield, 2020). From an SCT perspective, early experiences serve as critical sources of mastery experiences. Successful completion of science tasks builds self-efficacy, which in turn influences future engagement and persistence (Bandura, 1986).

2.4. Teacher Influence and Gender Bias in Science Classrooms

Teacher influence encompasses various ways teachers shape students' engagement with academic subjects through their instructional approaches, expectations, encouragement, and classroom interactions. Research suggests that teachers may sometimes hold unconscious gender stereotypes regarding students' abilities in science and mathematics (Lavy & Sand, 2018). Such gender bias may appear in subtle classroom practices, including differences in questioning patterns, feedback, and the allocation of learning opportunities (Sadker et al., 2010). When teachers provide more attention, encouragement, or challenging tasks to male students, they may inadvertently communicate that physics is more appropriate or attainable for boys than for girls.

Recent research has complicated our understanding of teacher influence and gender bias by revealing a significant perception–practice gap. Monteiro et al. (2025) conducted a cross-national study of STEM teachers and found that, while most teachers formally affirm gender equality in principle, they show limited awareness of the structural and cultural barriers girls face in STEM. These findings are particularly relevant to physics education, where subtle gender dynamics can significantly affect student engagement (Paul, 2026; Paul et al., 2025).

From an SEVT perspective, teacher influence shapes students' expectations and task values by structuring learning activities, providing feedback, and framing the relevance of subject content. From an SCT perspective, teachers serve as key agents of social persuasion and modeling. Interventions that provide positive feedback on ability have been shown to increase women's self-efficacy and interest in engineering domains (Giese et al., 2025).

2.5. Curriculum and Instructional Approaches in Physics Education

The structure and delivery of physics curricula can influence students' engagement with the subject. Traditional physics instruction often emphasizes abstract concepts and mathematical problem-solving, which may not always connect with students' everyday experiences (Murphy & Whitelegg, 2006). Studies suggest that contextualized teaching approaches that relate physics concepts to real-world situations can improve students' motivation and understanding (Haussler & Hoffmann, 2002). Instructional strategies, such as collaborative learning, inquiry-based activities, and practical experiments, can make physics learning more accessible and engaging for students. Recent research on active learning demonstrates that student-centred approaches significantly enhance performance and engagement across STEM disciplines (Freeman et al., 2014).

The design of laboratory experiences warrants particular attention, given recent findings on gender dynamics in these settings. Paul et al. (2025) found that qualitative feedback from female students often highlights challenges related to gender dynamics, including perceived assumptions about competence, being overlooked during discussions, and hesitation to voice opinions in male-dominated groups. These findings underscore the need for instructional strategies that actively promote equitable participation in laboratory settings.

2.6. Role Models and Mentorship in STEM

The presence of female role models in STEM fields plays an important role in motivating female students to pursue science-related careers. Role models challenge stereotypes and provide visible examples of success in scientific fields (Dasgupta & Stout, 2014). The stereotype inoculation model (Dasgupta, 2011) posits that exposure to ingroup members in stereotyped domains functions as a "social vaccine," increasing belongingness and protecting against stereotype threat.

Recent research has significantly advanced our understanding of the factors that make role models effective. Chen et al. (2026) found that perceiving academic similarity—in terms of abilities, interests,

or efforts—positively and robustly predicted students' STEM career motivation, whereas demographic similarity played a more limited role. Experimental studies have also demonstrated the effectiveness of role model interventions. Bleiberg et al. (2025) conducted a randomized controlled trial and found that girls assigned to female mathematics tutors showed significantly higher STEM interest (0.73 standard deviations) and were 3.9% more likely to earn at least a C- in Algebra I than girls assigned to male tutors.

In Ethiopia, as in many educational contexts, the number of female physics teachers and professionals remains limited. This lack of representation may restrict female students' opportunities to identify with same-gender role models in science. Mentorship programs connecting female students with women working in STEM fields have been shown to improve students' motivation, academic confidence, and career aspirations internationally (Packard, 2016).

2.7. Societal and Cultural Influences

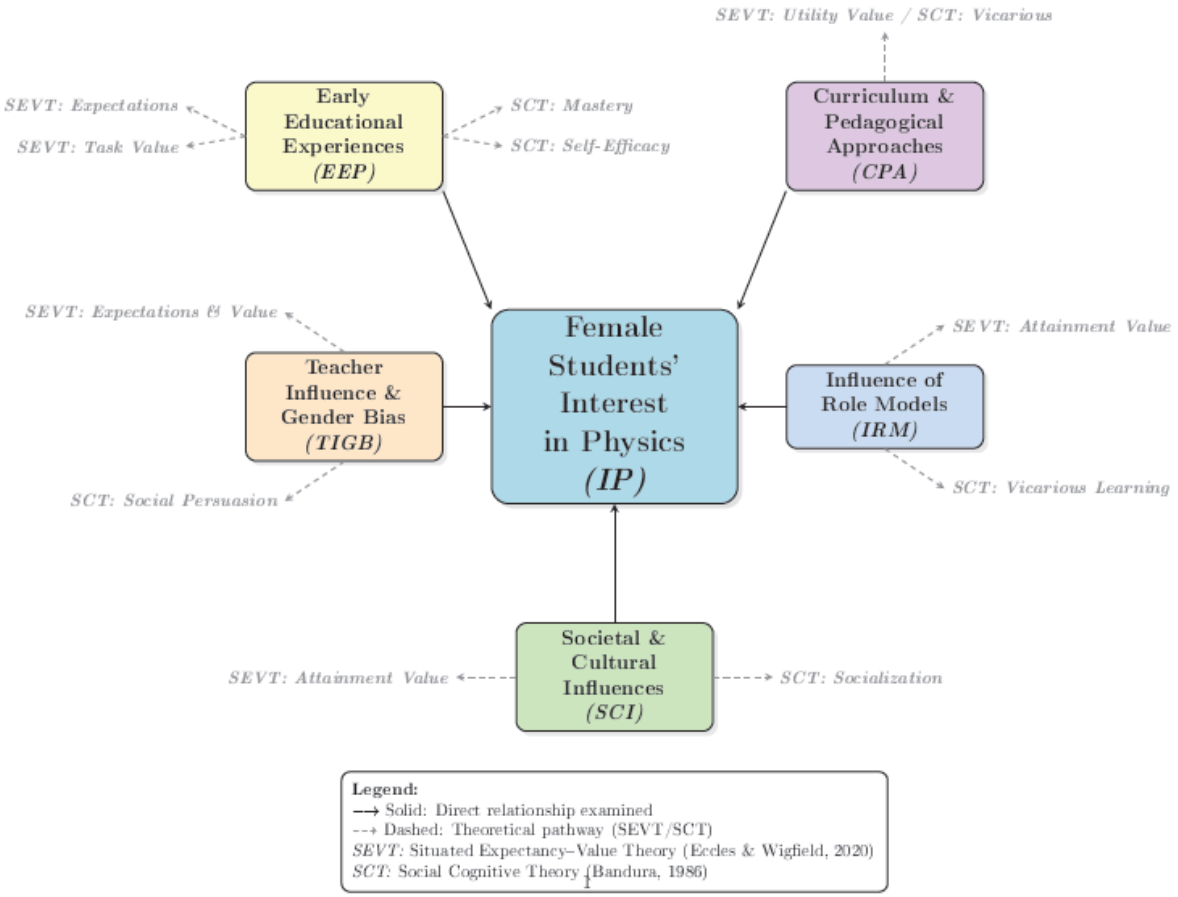
Students' academic choices are also shaped by broader societal and cultural influences. In many societies, traditional gender roles may discourage girls from pursuing careers in science and technology (Colclough et al., 2000). Family expectations, community attitudes, and media representations can influence students' perceptions of which subjects are appropriate for males or females. Recent research has highlighted the importance of social networks and peer relationships in shaping girls' STEM trajectories. Chen et al. (2026) found that objective social inclusion, particularly by male peers, was associated with stronger STEM intentions for girls, mediated by subjective belonging.

In Ethiopia, cultural norms and limited awareness of STEM career opportunities may influence female students' participation in science education (Egne, 2014). These influences may interact with classroom experiences, affecting students' interest and confidence in subjects such as physics.

2.8. Conceptual Framework

Based on the reviewed literature, this study proposes a conceptual framework (Figure 1) in which female students' interest in physics is influenced by multiple interconnected factors: early educational experiences, teacher influence and gender bias, curriculum and instructional approaches, exposure to female role models, and societal and cultural influences. Drawing on SEVT (Eccles & Wigfield, 2020), early educational experiences shape students' expectations for success and subjective task value in physics. From the perspective of SCT (Bandura, 1986), teacher influence and exposure to role models serve as sources of social persuasion and vicarious learning, contributing to the development of self-efficacy beliefs.

Figure 1 ***Conceptual Framework Illustrating Factors Influencing Female Students' Interest in Physics.***



3. Method

3.1. Research Design and Approach

This study employed a quantitative research design using a descriptive survey approach to examine the factors influencing female students' interest in physics. Descriptive survey designs are appropriate for investigating existing conditions, perceptions, and relationships among variables within a specific population (Creswell & Creswell, 2018). A quantitative research approach was adopted to examine the relationships between the independent variables (early educational experiences, teacher influence and gender bias, curriculum and instructional approaches, exposure to female role models, and societal and cultural influences) and the dependent variable (female students' interest in physics).

3.2. Study Area and Population

The study was conducted in the Kaffa Zone, Southwest Ethiopia, which is approximately 460 km from Addis Ababa. The area comprises both urban and rural settings, with several government secondary schools representing diverse socio-cultural contexts. The region was selected because of its limited female representation in science fields, particularly in physics (Egne, 2014; Semela, 2010). The target population comprised female students enrolled in Grades 9, 10, 11, and 12 who were studying physics during the 2024/2025 academic year. According to records from the Kaffa Zone Education Office, the total number of female students enrolled in physics across the four selected schools was approximately 1,200.

3.3. Sampling Technique and Sample Size

A multistage sampling technique was employed. First, four secondary schools (Gimbo Secondary School, Bishaw W/Yohannis Secondary School, Shishonde Secondary School, and Awrada Secondary School) were selected using purposive sampling based on: (a) accessibility, (b) presence of Grades 9–12, and (c) inclusion of both urban and rural schools. Second, the female student population within each school was stratified by grade level. Finally, participants were selected using simple random sampling within each stratum using the lottery method.

The sample size was determined using a single-population proportion formula with a 95% confidence interval:

$$n = Z^2 p(1 - p) / e^2 = (1.96)^2 \times 0.5(1 - 0.5) / (0.05)^2 = 384$$

where n is the minimum sample size, p = 50%, e is the margin of error (5%), and Z is the Z-score (1.96 for a 95% confidence level). Of the 384 distributed questionnaires, 352 were completed and returned, yielding a response rate of 91.7%.

3.4. Data Collection Instruments

Structured questionnaires were administered to female students currently enrolled in physics subjects. The questionnaire was developed by the researcher based on established instruments in STEM education research (Hazari et al., 2010; Lavy & Sand, 2018; Tenenbaum & Leaper, 2003) and adapted to the Ethiopian secondary school context. All items were measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Table 1 presents a summary of the questionnaire structure.

Table 1 ***Summary of Questionnaire Structure***

Sub-Dimension	Items	Scale Type	Sample Item
Independent Variables			
Early Educational Experiences	6	5-point Likert	"My teachers in primary school encouraged me to explore science subjects."
Teacher Influence and Gender Bias	6	5-point Likert	"My physics teacher encourages me to pursue a career in physics."
Curriculum and Pedagogical Approaches	4	5-point Likert	"The teaching methods used in my physics class are engaging and help me understand the material."
Influence of Role Models	4	5-point Likert	"Seeing female scientists in textbooks, media, or in person encourages me to pursue physics."
Societal and Cultural Influences	4	5-point Likert	"Cultural expectations sometimes discourage girls from pursuing subjects like physics."
Dependent Variable			
Interest in Physics	5	5-point Likert	"I find physics interesting and engaging."
Total	**29**		

Note. Response items were measured using a 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

3.5. Operationalization and Measurement of Variables

Dependent variable: Interest in Physics (IP) — self-reported interest, engagement, and motivation in physics studies and careers among female students.

Independent variables: Early Educational Experiences (EEP) — students' perceptions of their early exposure to science education, encouragement from primary school teachers, family support, and participation in science-related activities; Teacher Influence and Gender Bias (TIGB) — students' perceptions of their physics teachers' encouragement, equitable treatment, and classroom practices; Curriculum and Pedagogical Approaches (CPA) — students' perceptions of the relevance and inclusiveness of physics curriculum content and teaching methods; Influence of Role Models (IRM) — students' exposure to and perceptions of female role models in physics and STEM fields; Societal and Cultural Influences (SCI) — students' perceptions of community attitudes, cultural expectations, and family support regarding female participation in physics.

3.6. Validity and Reliability

To ensure content validity, the instruments were reviewed by a panel of three experts in science education and gender studies. A pilot study was conducted with 26 students from a neighboring school not included in the final sample. Construct validity was assessed using principal component analysis (PCA) with Varimax rotation. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.847, exceeding the recommended threshold of 0.60 (Kaiser, 1974). Bartlett's test of sphericity was significant ($\chi^2 = 2640.313$, $df = 406$, $p < .001$), confirming suitability for factor analysis (Tabachnick & Fidell, 2019). The factor analysis extracted nine components with eigenvalues greater than 1.0, accounting for 59.65% of the total variance.

The reliability of the questionnaire was evaluated using Cronbach's alpha coefficient. The overall instrument demonstrated excellent internal consistency, with a Cronbach's alpha of 0.951 (Cronbach, 1951). Reliability coefficients for individual constructs ranged from 0.701 to 0.924. Table 2 presents the reliability statistics.

Table 2 ***Reliability Statistics for Study Constructs***

Construct	Cronbach's Alpha	Number of Items
Early Educational Experiences (EEP)	0.854	6
Teacher Influence and Gender Bias (TIGB)	0.897	6
Curriculum and Pedagogical Approaches (CPA)	0.701	4
Influence of Role Models (IRM)	0.924	4
Societal and Cultural Influences (SCI)	0.900	4
Interest in Physics (IP)	0.874	5
Overall Instrument	0.951	29

Note. All reliability coefficients exceeded the recommended threshold of 0.70 (Numally & Bernstein, 1994).

3.7. Data Analysis

After data collection, the completed questionnaires were edited for completeness, coded, and entered into SPSS version 23. The data were analyzed using both descriptive and inferential statistics.

Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize demographic characteristics and study variables. Inferential statistics, including Pearson's correlation analysis and multiple regression analysis, were used to examine relationships and identify significant predictors of interest in physics.

3.8. Model Specification

Linear regression analysis was conducted to model the relationship between the dependent and independent variables:

$$IP = f(EEP, TIGB, CPA, IRM, SCI)$$

Transforming into a multiple regression model:

$$IP = \beta_0 + (\beta_1 \times EEP) + (\beta_2 \times TIGB) + (\beta_3 \times CPA) + (\beta_4 \times IRM) + (\beta_5 \times SCI)$$

where β_0 = constant; β_1, β_2, β_3, β_4, and β_5 = regression coefficients.

3.9. Ethical Considerations

The study adhered to ethical standards in research and ensured informed consent from all participants. Confidentiality was maintained, and participants were assured that their responses would be used solely for research purposes. Permission was obtained from the relevant educational authorities and school administrations before data collection.

4. Findings

4.1. Response Rate and Demographic Characteristics

Of the 384 questionnaires distributed, 352 were completed and returned, representing a response rate of 91.7%, which is more than sufficient for generalization (Ary et al., 2014). The demographic characteristics are summarized in Table 3. The largest age group was 15–17 years (48.3%), followed by those under 15 years (32.7%). Most respondents were in the 10th grade (53.4%), followed by the 9th grade (32.4%). The majority of students (73.6%) were taught by male physics teachers, highlighting a gender imbalance in STEM education. More than half of the respondents' parents (54.5%) had only primary education.

Table 3 ***Demographic Characteristics of Participating Students***

Variable	Category	%
Age	Under 15	32.7
	15–17	48.3
	18–20	12.5
	Above 20	6.5
Grade level	9th	32.4
	10th	53.4
	11th	4.3
	12th	9.9

Variable	Category	%
Teacher Gender	Students taught by female physics teachers	26.4
	Students taught by male physics teachers	73.6
Parents' Educational Background	Uneducated	11.6
	Primary	54.5
	Secondary	16.5
	Graduate or post-graduate	17.3

4.2. Descriptive Statistics of Study Variables

Table 4 presents the descriptive statistics for the key study variables. The mean interest in physics was 3.49 (SD = 0.89), indicating a moderate level of engagement among female students. Early educational experiences had a mean of 3.39 (SD = 0.81), while teacher influence and gender bias scored 3.58 (SD = 0.67). Curriculum and pedagogical approaches received the highest mean score (3.78, SD = 0.68), and societal and cultural influences received the lowest (2.99, SD = 0.83).

Table 4 ***Descriptive Statistics of Key Study Variables***

Variable	Mean	Standard Deviation
Early Educational Experiences (EEP)	3.39	0.81
Teacher Influence and Gender Bias (TIGB)	3.58	0.67
Curriculum and Pedagogical Approaches (CPA)	3.78	0.68
Influence of Role Models (IRM)	3.46	0.88
Societal and Cultural Influences (SCI)	2.99	0.83
Interest in Physics (IP)	3.49	0.89

Note. N = 352. All variables were measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

4.3. Correlation Analysis

Pearson's correlation analysis was conducted to assess the relationships between the independent variables and students' interest in physics. Table 5 presents the correlation coefficients. Early educational experiences were strongly correlated with interest in physics ($r = 0.591$, $p < .001$), followed by the influence of role models ($r = 0.526$, $p < .001$). Teacher influence and gender bias ($r = 0.459$, $p < .001$), societal and cultural influences ($r = 0.386$, $p < .001$), and curriculum and pedagogical approaches ($r = 0.365$, $p < .001$) also showed significant but weaker correlations.

Table 5 ***Pearson Correlation Coefficients Between Study Variables***

	IP	EEP	TIGB	CPA	IRM
IP	1.000				

	IP	EEP	TIGB	CPA	IRM
EEP	0.591**	1.000			
TIGB	0.459**	0.581**	1.000		
CPA	0.365**	0.346**	0.434**	1.000	
IRM	0.526**	0.455**	0.461**	0.284*	1.000
SCI	0.386**	0.367**	0.330**	0.225**	0.397**

*Note. N = 352. IP = Interest in Physics; EEP = Early Educational Experiences; TIGB = Teacher Influence and Gender Bias; CPA = Curriculum and Pedagogical Approaches; IRM = Influence of Role Models; SCI = Societal and Cultural Influences. ** p < .001; * p < .05.*

4.4. Regression Analysis

4.4.1. Assumption Testing

Before conducting the multiple regression analysis, the assumptions of normality, linearity, homoscedasticity, and absence of multicollinearity were tested. The normal probability plot (P-P plot) confirmed that the residuals were normally distributed. Scatterplots confirmed linearity and homoscedasticity. Multicollinearity was assessed using the variance inflation factor (VIF) and tolerance statistics. All VIF values were below 2 (ranging from 1.263 to 1.772), and tolerance values were above 0.1 (ranging from 0.564 to 0.792) (Table 6), indicating no multicollinearity issues (Field, 2018). The Durbin-Watson statistic was 1.629 (Table 7), suggesting no significant autocorrelation in the residuals.

Table 6 ***Collinearity Statistics***

Collinearity Statistics		
	Tolerance	VIF
EEP	0.596	1.678
TIGB	0.564	1.772
CPA	0.792	1.263
IRM	0.687	1.456
SCI	0.791	1.265

4.4.2. Model Summary

The regression model explained 46.0% of the variance in female students' interest in physics (R^2 = 0.460, Adjusted R^2 = 0.452, F(5, 346) = 58.864, p < .001). This indicates that the independent variables collectively accounted for nearly half of the variation in students' interest in physics.

Table 7 ***Model Summary***

Model	R	R^2	Adj. R^2	Std. Error	Durbin-Watson
1	0.678	0.460	0.452	0.66028	1.629

4.4.3. Regression Coefficients

Table 8 presents the regression coefficients. Early educational experiences (β = 0.405, p < .001) and the influence of role models (β = 0.270, p < .001) were the strongest predictors of interest in physics. Curriculum and pedagogical approaches (β = 0.161, p = .006) and societal and cultural influences (β = 0.114, p = .018) also significantly contributed to the model. Teacher influence and gender bias were not significant predictors (β = 0.045, p = .524).

Table 8 ***Multiple Regression Coefficients for Predictors of Physics Interest***

Predictor	Unstd. β	Std. Error	Std. β	t	p-value
(Constant)	0.072	0.239		0.299	0.765
EEP	0.405	0.056	0.369	7.215	0.000
TIGB	0.045	0.070	0.034	0.637	0.524
CPA	0.161	0.058	0.123	2.777	0.006
IRM	0.270	0.048	0.266	5.575	0.000
SCI	0.114	0.048	0.106	2.383	0.018

The resulting regression equation is:

$$IP = 0.072 + (0.405 \times EEP) + (0.161 \times CPA) + (0.270 \times IRM) + (0.114 \times SCI)$$

4.5. Summary of Results

The key findings from the statistical analysis are:

- Early educational experiences had the strongest positive relationship with physics interest (r = 0.591, β = 0.405, p < .001), indicating that students with more positive early science experiences reported higher interest in physics.
- The influence of role models was strongly positively related to physics interest (r = 0.526, β = 0.270, p < .001), suggesting that exposure to female role models significantly enhances interest.
- Curriculum and pedagogical approaches had a moderate positive relationship with physics interest (r = 0.365, β = 0.161, p = .006), indicating that inclusive and engaging teaching methods contribute to interest.
- Societal and cultural influences had a modest positive relationship with physics interest (r = 0.386, β = 0.114, p = .018), suggesting that supportive community attitudes enhance interest.
- Teacher influence and gender bias were not significant predictors (β = 0.045, p = .524), contrary to expectations based on previous research.

5. Discussion

The findings of this study provide important insights into the factors influencing female students' interest in physics in Ethiopian secondary schools, interpreted through the complementary lenses of SEVT and SCT. The regression model explained 46.0% of the variance in physics interest, with early educational experiences and exposure to female role models emerging as the strongest predictors.

5.1. The Strong Influence of Early Educational Experiences

The findings revealed that early educational experiences were the strongest predictors of female students' interest in physics. Students who reported positive early exposure to science learning activities were more likely to demonstrate interest in physics. This finding is consistent with a substantial body of research showing that early engagement with science significantly influences students' attitudes toward STEM subjects (Hazari et al., 2010). These results align with recent intervention studies: Miranda (2025) found that hands-on STEM programs for elementary-aged girls significantly enhanced participants' interest, self-efficacy, and career aspirations. Similarly, experimental research by Huang et al. (2026) showed that even brief interventions, such as pretending to be a scientist, can boost girls' persistence in science activities.

According to SEVT (Eccles & Wigfield, 2020), positive early science learning experiences can increase students' confidence and the perceived value of science education, thereby increasing their likelihood of pursuing physics at higher levels of study. The strong predictive power of early experiences in this study suggests that interventions targeting elementary science education may be particularly effective in promoting gender equity in physics.

5.2. The Role of Female Role Models

The results also indicated that exposure to female role models significantly influenced female students' interest in physics. Students who were aware of successful women in science fields showed greater motivation to pursue physics. This finding supports previous research indicating that female role models can help challenge stereotypes about gender and scientific ability (Dasgupta & Stout, 2014). Recent research by Chen et al. (2026) found that perceiving academic similarity—particularly in terms of effort—to role models positively predicts STEM career motivation, especially for students from marginalized groups. Bleiberg et al. (2025) demonstrated that girls assigned to female mathematics tutors showed significantly higher STEM interest and improved course performance. These findings have important implications for the Ethiopian context, where increasing the visibility of female scientists and physics teachers could significantly enhance girls' motivation.

5.3. The Impact of Curriculum and Teaching Methods

The findings also revealed that curriculum and instructional approaches significantly influenced female students' interest in physics. Student-centered teaching approaches allow learners to actively participate in the learning process, thereby enhancing motivation and interest. Hands-on learning experiences are particularly important in physics education because they allow students to connect abstract concepts with real-world applications (Haussler & Hoffmann, 2002). The design of laboratory experiences deserves particular attention in light of recent research on gender dynamics: Paul (2026) found significant differences in task preferences and comfort levels, while Paul et al. (2025) documented qualitative reports from female students describing exclusion from group discussions. These findings suggest that educators must be intentional about promoting equitable participation.

5.4. The Moderate Effect of Societal and Cultural Influences

Sociocultural factors also influenced female students' interest in physics. Family encouragement and positive societal attitudes toward science careers contributed to higher levels of student motivation. Recent research by Chen et al. (2026) found that objective social inclusion, particularly by male peers, was associated with stronger STEM intentions for girls. In Ethiopia, where traditional gender roles may influence educational choices, community awareness programs and family engagement initiatives could play an important role in supporting girls' science education.

5.5. Teacher Influence and Gender Bias

Contrary to expectations based on previous research (Lavy & Sand, 2018; Sadker et al., 2010), teacher influence and gender bias did not emerge as significant predictors of female students' interest in physics. This finding suggests that students in the sampled schools may not perceive discriminatory treatment from teachers as strongly. The mean score for teacher influence and gender bias (M = 3.58, SD = 0.67) suggests that students generally perceive teachers as relatively supportive. This may indicate that teacher attitudes toward gender equity in science education are evolving positively in this context. Additionally, students may not interpret teacher behaviors as gender-biased, even if subtle differences exist, consistent with the perception–practice gap documented by Monteiro et al. (2025). Other factors, such as early experiences and role models, may have stronger influences that overshadow the effects of teacher bias.

5.6. Theoretical Implications

The findings support the use of SEVT and SCT as interpretive frameworks for understanding the direct relationships between contextual factors and female students' interest in physics. The strong effects of early educational experiences (interpreted through SEVT as shaping expectations and task value, and through SCT as providing mastery experiences) and role models (interpreted through SCT as vicarious learning) highlight how both motivational beliefs and social-cognitive processes operate simultaneously to shape engagement. The non-significant finding for teacher gender bias raises important questions about the mechanisms through which teachers influence female students' motivation, consistent with SCT's emphasis on social persuasion as a key source of self-efficacy (Bandura, 1986).

6. Conclusion and Recommendations

6.1. Conclusions

This study examined the roles of early educational experiences, teacher influence and gender bias, curriculum and instructional approaches, female role models, and sociocultural influences in shaping female students' interest in physics in secondary schools in the Kaffa Zone, Southwest Ethiopia. The results indicate that early educational experiences play a critical role in shaping female students' interest in physics, consistent with recent intervention research (Miranda, 2025; Huang et al., 2026). Female role models significantly influence students' motivation, with recent research emphasizing the importance of perceived academic similarity (Chen et al., 2026). Curriculum and instructional approaches, as well as sociocultural influences, also had significant effects. However, teacher influence and gender bias did not show statistically significant effects, which may reflect the complexity of measuring perceived bias or indicate positive changes in teachers' attitudes.

6.2. Recommendations

6.2.1. Strengthening Early Science Education

Educational policymakers and curriculum developers should strengthen science education at the primary and lower secondary levels. Schools should encourage practical science activities, inquiry-based learning, and hands-on experiments to stimulate students' curiosity. Evidence from intervention studies (Miranda, 2025; Huang et al., 2026) suggests that even brief, well-designed early interventions can have lasting impacts on girls' engagement in science.

6.2.2. Promoting Equitable Teacher Influence and Addressing Gender Bias

Teachers should adopt inclusive and equitable practices. Given recent findings on subtle gender dynamics in laboratory settings (Paul, 2026; Paul et al., 2025), teachers should be particularly

attentive to ensuring equitable task allocation. Professional development programs should address the perception–practice gap identified by Monteiro et al. (2025), emphasizing the importance of providing equal encouragement, feedback, and opportunities to all students, regardless of gender.

6.2.3. Increasing Visibility of Female Role Models in STEM

Educational institutions should promote the visibility of female scientists through mentorship programs, guest lectures, and career guidance activities. Research suggests that emphasizing academic similarity—particularly shared efforts and challenges—may enhance role model effectiveness (Chen et al., 2026). Evidence from randomized controlled trials demonstrates that gender-matched tutoring can significantly improve girls' STEM outcomes (Bleiberg et al., 2025).

6.2.4. Improving Curriculum and Instructional Approaches

Curriculum developers and educators should design instructional materials that connect physics concepts with real-life applications. Given documented gender differences in task preferences within laboratory settings, instructors should structure activities to ensure that all students gain experience with both hands-on equipment and analytical tasks (Paul, 2026).

6.2.5. Addressing Sociocultural Barriers

Awareness programs should be organized to challenge gender stereotypes and promote positive attitudes toward girls' participation in science. Schools, families, and communities should work together to encourage female students to pursue science education and careers in STEM fields. Recent research highlighting the importance of peer networks (Chen et al., 2026) suggests that fostering inclusive friendship groups within STEM contexts may be a valuable strategy.

6.2.6. Recommendations for Future Research

Future studies may explore additional factors influencing female students' participation in physics, including peer networks, students' self-efficacy beliefs, and school resources. Qualitative research approaches, including classroom observations and in-depth interviews, could provide deeper insights into subtle gender dynamics (Paul et al., 2025). Comparative studies across different regions of Ethiopia would help determine whether the findings can be generalized. Future research should also include explicit measures of teacher influence and gender bias using multiple methods, including classroom observations.

6.3. Limitations of the Study

This study has several limitations. First, the use of self-report questionnaire data may not fully capture the complexity of students' experiences, particularly subtle gender dynamics documented through qualitative methods (Paul et al., 2025). Second, the study was conducted only in selected secondary schools in the Kaffa Zone, which limited its generalizability. Third, other important variables, such as peer networks (Chen et al., 2026), students' self-efficacy beliefs, parental support, and specific school resources, were not included. Fourth, the cross-sectional design limits the ability to establish causal relationships. Finally, incorporating qualitative methods could provide deeper insights into students' experiences.

7. Declarations

7.1. Author Contributions (CRediT)

Tewodros Adaro Gatissa: Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing – Original Draft, Writing – Review and Editing, Visualization, Project Administration. The author has read and approved the final version of the manuscript and takes full responsibility for all aspects of the work.

7.2. Conflict of Interest

The author declares no financial, commercial, institutional, or personal relationships that could have appeared to influence the work reported in this paper. The research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

7.3. Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to ethical considerations and the need to protect participant confidentiality, the data are not publicly accessible. However, they may be shared with qualified researchers who provide evidence of appropriate institutional ethical approval and agree to comply with relevant data protection regulations.

7.4. Funding Statement

This research received no specific grant from any public, commercial, or not-for-profit funding agency. The study was conducted independently, without external financial support.

7.5. Ethics Approval

Prior to data collection, permission was obtained from the relevant educational authorities and school administrations in accordance with standard research ethics procedures. All participants were fully informed about the purpose, scope, and voluntary nature of the study before providing their informed consent. Participant confidentiality and anonymity were maintained throughout all stages of the research process, and all data were handled in compliance with applicable ethical guidelines.

7.6. Use of Artificial Intelligence (AI) Tools

The author declares that no AI-assisted tools were used at any stage of the preparation of this manuscript, including writing, data analysis, or figure generation. All content is the sole intellectual work of the author.

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Evaluation of primary school students' awareness about environmental ıssues

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ABSTRACT

This study aims to examine primary school students' awareness of environmental issues by analysing their drawings as reflective pedagogical tools. The Environmental Attitude Scale (EAS) was applied to 208 randomly selected students. The data were analysed using SPSS, and students' total attitude scores were calculated and ranked. Based on these scores, ten students representing high, medium, and low levels of environmental attitudes were selected through maximum variation sampling, forming a final study group of 30 students. The research data were collected using the Draw an Environment Test (DAET) and analysed through descriptive analysis. The analysis was guided by the "Multidimensional Assessment of Environmental Issues" framework. The findings revealed that students predominantly depicted environmental issues related to pollution, natural resource use, and flora and fauna. In contrast, drawings addressing climatic issues, social dimensions of environmental issues, and natural or human-induced disasters were considerably limited. Moreover, no representations were found regarding nuclear pollution, visual pollution, melting glaciers, nuclear accidents, or issues related to poverty and hunger. These findings indicate that although primary school students demonstrate a basic level of environmental awareness, their perceptions are largely confined to concrete, observable, and locally experienced environmental issues. The limited representation of global, abstract, and systemic environmental issues suggests that students' understanding of the environment remains surface-oriented. In this context, the study presents empirical evidence highlighting the critical role of early and comprehensive environmental education in enabling children to develop multidimensional environmental awareness, internalize sustainability values, and establish a meaningful connection with the natural environment.

KEYWORDS: Environmental education; Environmental awareness; Environmental issues; Primary school; Draw an Environment Test (DAET)

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1. Introduction

The importance of nature to human life and the need to preserve the environment are two of the most basic and significant issues. Therefore, environmental awareness and environmental matters are gaining significance day by day. It is of great importance to gain awareness of these matters from an early age. As the next generation of adults, primary school students have a strong opportunity to become interested in environmental issues and develop positive attitudes. Many studies show that developing environmental behaviour and awareness at an early age is more enduring than at later

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ages. Since interest in nature and environmental activities declines with age, younger age groups are more interested in such subjects. It also emphasises the importance of encouraging interest in nature in environmental education programmes (Neurohr et al., 2024). For educational studies on environmental awareness and sustainability, it is essential to comprehend and assess children's awareness of the environment and related issues.

Education, especially primary school education, plays a critical role in developing sensitivity, awareness, and attitude towards the environment (Balkan Kıyıcı, 2009). Raising children's awareness of environmental problems and fostering positive attitudes towards them will lead to important individual and social changes. It is crucial to understand the environmental issues children perceive during this process to take appropriate action and make further efforts. This is because environmental issues not only threaten individual lives but also directly affect society, natural resources, and future generations. The UNICEF report on the direct exposure of a child born in 2020 to environmental problems and disaster experience compared to a child born in 1960 (UNICEF, 2022):

- 2.6 times more drought events;
- 2.8 times more river flooding;
- 2.8 times more crop failures;
- 2 times more forest fires;
- 6.8 times more heat wave exposure.

According to the United Nations (UN), about half of the world's population lives in urban areas (United Nations, 2007), and this rate is expected to reach 70% by 2050 (United Nations, 2011). This situation indicates that living standards will become more difficult, and all disciplines should produce different solutions in their own fields or in interdisciplinary cooperation. As a matter of fact, studies have shown that the authenticity of the learning environment, the rich opportunities of the physical environment, the use of different types of information sources by students, and interdisciplinary thinking can enable them to establish a close relationship with the environment and produce solution-oriented ideas and behaviours (Tan & So, 2018).

Environmental problems pose a great threat on a global scale. In this sense, the field of education should also take responsibility, address environmental issues, and raise individuals who are prone to taking action. People raised in this manner will have an important capacity to handle future environmental challenges and threats (Ayvacı & Çoruhlu, 2009). It is a major concern for the future of our planet that humans, who are ultimately consumers, should be taught environmentally responsible behaviors, such as thinking responsibly when consuming, producing less waste, using less, and reusing more. In a study conducted on this subject, it is stated that conducting waste studies, such as reducing waste and reusing waste in early learning environments, leads individuals to question the principles of recycling. For good waste disposal, it is stated that waste practices such as reducing, reusing, and recycling enable individuals to realise sustainable systems (Merewether et al., 2023).

Studies that increase people's attitudes and awareness from an early age are considered the most effective approach to preventing and improving environmental problems. Previous studies show that environmental education given at later ages increases knowledge but has little effect on attitude change (Pooley & O'Connor, 2000). Accordingly, if the proper mindset and level of awareness are not developed, people might believe that environmental issues are unrelated to their own responsibilities and refrain from accepting responsibility (Kışoğlu et al., 2016). Numerous studies have investigated the relationship between children's environmental actions and their emotional attachment to nature

and ecological beliefs (Collado et al., 2013; Mackay & Schmitt, 2019). Therefore, it is very important for children to develop awareness of and be encouraged about environmental issues from an early age to acquire environmentally friendly attitudes and behaviours (Atasoy, 2005; Chawla, 2009). To develop environmental awareness that enables children to exhibit more sensitive behaviours through education, determining their current awareness levels is a primary step.

Environmental awareness goes beyond understanding environmental issues; it also involves caring about them, adopting a solution-oriented mindset, and acting constructively. A child who grows up with this kind of awareness is likely to be an environmentally informed, sensitive, and consistent individual who makes efforts to keep the environment clean in the years that follow (Kuzu, 2008; Kamaruddin et al., 2016). It is crucial for children to have environmental knowledge and awareness to appreciate and love nature (Hazır Bıkmaz & Akben, 2007). Early childhood is now considered a critical time for acquiring knowledge and awareness, as well as for the development of the mind, body, and emotions. Therefore, the importance of the preschool and primary school period in raising awareness and knowledge about the environment is particularly evident (Ayvaz et al., 1999; Balkan Kıyıcı, 2009). Education tailored to children's grades and interests can be effective in this regard. In fact, a study aimed at teaching children about soil and related concepts found that the training significantly increased children's understanding of soil (Gülay Ogelman et al., 2015).

Numerous studies on children's awareness of environmental problems have reported that children generally have some ideas about local environmental problems and basic types of pollution, but this knowledge is often limited and insufficient, leading to inaction towards solutions (Akkaş Şahin, 2021; Barraza, 1999; Grodzińska-Jurczak et al., 2006; Sethusha, 2006). Children were mostly observed to depict environmental problems and a polluted environment with elements such as garbage, household waste, polluted air, and water, while they depicted the clean environment as a living space full of green color, trees, and other living things (Akkaş Şahin, 2021; Koraş, 2019; Pınar, 2019). Similarly, in another study, it was determined that student drawings depicted basic concepts such as water, air, trees, waste, etc.; however, after the Climate Change Education Program, there were significant changes in students' awareness and attitudes towards climate change, environmental problems, and sustainability (Pala, 2024).

Primary school students with insufficient environmental awareness may develop an insensitive attitude towards nature and the environment. As a result, natural resources are depleted, health issues rise, and polluting behaviors take shape. For this reason, high-quality environmental education programs are essential to ensure that primary school students develop environmentally friendly awareness, attitudes, and behaviors. To prepare these programs, it is essential to accurately assess and disclose the level of environmental awareness.

While many studies have explored children's environmental awareness through surveys and interviews, fewer have analyzed its multifaceted nature using visual representations. Fewer investigations have specifically examined the boundaries of children's environmental perceptions—what they fail to notice, envision, or understand—despite the pedagogical significance of these deficiencies. For this purpose, the present study examined 3rd-grade primary school students' awareness of environmental problems through their drawings. This is because the most fundamental characteristic of children's drawings is to reveal children's ways of thinking, and children's drawings contain much deeper meanings than they appear. From a picture, it is possible to infer the child's developmental characteristics, abilities, feelings, and perceptions (Yavuzer, 2011). Therefore, children's drawings are of great importance as a way of explaining the child's complex and vast universe. In research conducted with children, it has been observed that their thoughts, images, and

perceptions are evident in their drawings (Rodari, 2007). Through drawings, children can recognize their feelings, make sense of the structures in their inner worlds, and express their genuine desires and ideas.

The literature suggests that elementary school students possess some basic awareness of their environment, but the extent to which this awareness is internalized remains unclear. Existing studies mostly focus on measuring students' attitudes or knowledge levels, offering a limited understanding of the quality of children's perceptions of the environment. Furthermore, there is little clarity regarding the boundaries of environmental problem elements that students cannot perceive or identify. This study seeks to address this problem through drawings and textual expressions that provide direct insight into the life experiences and environmental awareness of third-grade elementary school students. The research aims to reveal both the prominent and deficient aspects of environmental problems through students' visuals and written representations that accompany their drawings.

2. Method

2.1. Research Design

Phenomenology, a qualitative research method, was used in the present study. Phenomena in the world we live in present themselves to us in different ways, such as experiences, events, perceptions, concepts, orientations, and situations. Phenomenological research is a study design that seeks to obtain a full understanding of the character, significance, and scope of everyday experiences arising from these factors (Bal, 2016; Husserl, 2012). The phenomenology design deals with phenomena that we are aware of but do not have an in-depth understanding of. The aim here is to understand the essence of a phenomenon by reaching a common understanding through the experiences of individuals (Creswell, 2018; Yıldırım & Şimşek, 2016). In other words, phenomenology is the process of seeing the essence of a phenomenon beyond its external appearance, getting to that essence, and comprehending it (Patton, 2014). From this perspective, the study adopts a phenomenological approach, considering children's drawings not only as visual aesthetics but also as lived expressions of students' subjective experiences and the meanings they attribute to environmental issues.

2.2. Participants and Procedure

The research was conducted with 3rd-grade primary school students in the Melikgazi District of Kayseri Province during the 2022–2023 academic year. The study group consisted of 30 students selected using maximum diversity sampling from the data of the "Environmental Attitude Scale for Primary School Students (EAS)" administered to a randomly selected total of 208 primary school 3rd-grade students, comprising 94 males and 114 females. In maximum diversity sampling, a heterogeneous group is formed by choosing participants with different characteristics (Creswell, 2021). Purposive sampling methods, such as maximum variation, are frequently used in qualitative research. This approach aims to reach scenarios that contain rich data for the study's depth (Patton, 2014).

To ensure maximum diversity in the study, students with varying environmental attitudes were chosen because their attitudes can influence their understanding of environmental issues (Atasoy, 2019). Accordingly, "Environmental Attitude Scale for Primary School Students (EAS)" was applied to 208 students. Scores obtained from the scale were calculated using SPSS. The total scores obtained from the scale were ranked from high to low. This way, the top, bottom, and middle ten students were determined. A total of 30 students, 10 students from high environmental attitude level (H), 10 students from medium environmental attitude level (M), and 10 students from low environmental attitude level (L) were included in the present study.

2.3. Measures

In the present study, students' demographic information was obtained using the "Personal Information Form". "Environmental Attitude Scale for Primary School (EAS)" was used to determine which students to include in the study. Qualitative data were obtained by applying "Draw an Environment Test (DAET)", which includes drawings and explanations of students about environmental problems, to 30 students who were determined to have different attitude levels.

The Environmental Attitude Scale for Primary School (EAS) was developed by Artvinli and Demir (2018) to assess primary school students' attitudes towards the environment. The scale consists of 3 sub-dimensions: 27 items in the Positive Environmental Behaviors dimension, 10 items in the Environmental Knowledge and Awareness Dimension, and 6 items in the Negative Environmental Behaviors dimension, for a total of 43 items. According to the validity and reliability study conducted by Artvinli and Demir (2018), the factor loads of the scale items are in the range of .32–.85. Cronbach's Alpha coefficient is between 0.71 and 0.94 in the subscales and 0.93 in the whole scale.

The Draw an Environment Test (DAET) is an adaptation of Chambers's (1983) Draw a Scientist Test (DAST) for environmental issues. An A4-sized sheet of paper is divided into two sections. In the first section, there is a space for students to draw a picture about environmental issues. In the second section, there is space for students to draw and write about the depicted environmental issue. Students were given one class hour (40 minutes) for the Draw an Environment Test.

2.4. Data Analysis

EAS data collected to determine the study group were entered into SPSS. The sum of the scores from the EAS items was calculated using SPSS. The total scores of the students from EAS were ranked from high to low. Descriptive analysis, a qualitative method, was used to examine data obtained from the Draw an Environment Test (DAET).

Descriptive analysis aims to systematically organize and interpret the data collected in the study. The data are typically categorized based on pre-designed themes, cause-and-effect links between the results are established, and summaries and comparisons are made (Kitzinger, 1995; Kvale, 1994; Patton, 2014). In the present study, the deductive method was adopted for descriptive analysis. In deductive analysis, data are examined using predetermined codes and themes. In analyzing the student drawings through descriptive analysis, an evaluation table with codes and themes was created by using Atasoy's (2015) "Multidimensionality of Environmental Problems" table. The data were analyzed and evaluated according to this table. Radar graphs were used to present the data more concretely. Radar graphs show the distance of a theme or code from the central point, indicating its density in the data. If a theme or code is at the center, it means it is not encountered in the drawings; if it is at the farthest point from the center, it means it is frequently encountered in the drawings.

2.5. Validity, Reliability, and Ethical Considerations

In qualitative research, it is very important that different researchers examine, compare, and reconcile the findings to ensure the reliability of measurement results (Büyüköztürk et al., 2018). An agreement between independent evaluators is used to examine the reliability of results. High inter-coder agreement indicates high reliability (Büyüköztürk et al., 2018). According to Miles, Huberman, and Saldana (2014), there should be 85–90% agreement between coders.

In this regard, the student drawings in the present study were evaluated through descriptive analysis using the evaluation table, which contains codes and themes derived from Atasoy's (2015) "Multidimensionality of Environmental Problems" table. The drawings were analyzed by two different

evaluators. The results of the analysis were calculated as 90% using Miles and Huberman's (1994) reliability percentage formula (Agreement / (Total Agreement + Disagreement)). This rate was considered acceptable for internal consistency.

Afterwards, the evaluators analyzed the items on which they disagreed one by one and reached a consensus. To support the results and provide a clear, accurate picture of the perspectives of the students who participated in the study, direct quotations were included. Using these techniques, the goal was to thoroughly and methodically analyze the data and clearly present the results.

Necessary permissions and approvals were obtained to ensure ethical compliance in the study. Therefore, ethics committee approval was obtained from Erciyes University Social and Human Sciences Ethics Committee. Afterwards, permission for the research application was obtained from the Kayseri Provincial Directorate of National Education. Parental consent forms were obtained from all participants, and thus the study was conducted in accordance with all necessary ethical procedures.

3. Findings

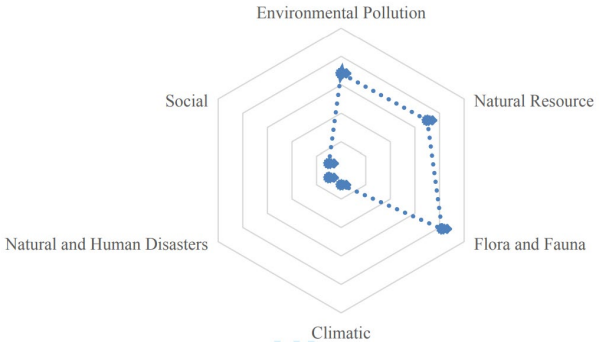
Before selecting the qualitative study group, the Environmental Attitude Scale (EAS) was administered to 208 third-grade students, the study's subjects, to determine the general distribution of environmental attitudes. Descriptive statistics revealed that the students' average environmental attitude scores were near the moderate level (M = 2.28, SD = 0.37), with scores ranging from 1.42 to 2.94 (Table 1). The distribution played a significant role in identifying relatively high, medium, and low attitude groups among the students. Based on the results and rankings derived from students' averages, the High attitude group had the highest scores, the Low attitude group the lowest, and the Medium group had student drawings close to the average. Consequently, 10 students representing different attitude levels were selected, and a total of 30 students' drawings were examined.

Table 1 ***Statistics of Environmental Attitude Scale (EAS) Scores***

Variable	N	Mean	SD	Min	Max
Environmental Attitude Total Score	208	2.28	0.37	1.42	2.94

30 drawings by primary school students were selected and analyzed using the "Multidimensionality of Environmental Problems" table. In the drawings, the themes of Flora and Fauna and Natural Resource Utilization are the most often mentioned environmental issues. Climatic, Natural-Human, and Social themes, which are relatively less common than these themes, were included in the drawings at a similar rate. The findings regarding primary school students' drawings on environmental issues are shown in Figure 1.

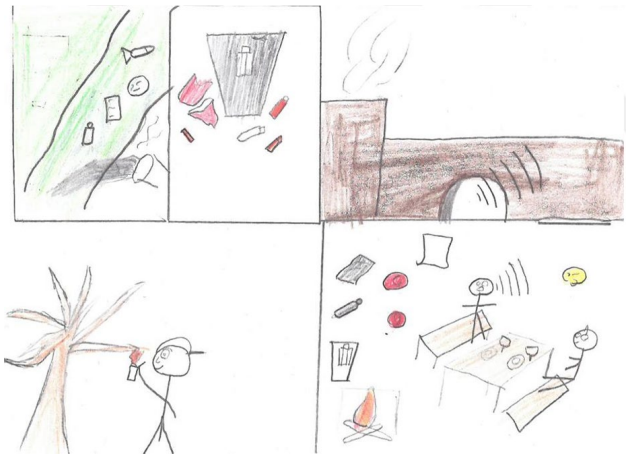
Figure 1 ***The inclusion of environmental issues in drawings***



When Figure 1 is analyzed, it is evident that students included all dimensions of environmental issues, but mostly depicted the environmental problems they observed in their immediate surroundings. While there were more drawings related to environmental pollution, natural resources, flora and fauna, there were relatively fewer drawings related to climatic, natural, and human disasters, as well as the social dimension. During the analysis, it was noteworthy that environmental problems such as "air, water, soil pollution, garbage and waste problems", which can be directly observed and directly exposed, were found in almost every drawing, while environmental problems that cannot be directly observed such as "global warming, acid rain, ozone depletion, melting glaciers" were not found in any drawing.

The drawings requested of the students were examined in detail within the specified dimensions. At the same time, the students' explanations of their drawings in writing, in addition to their drawings, enabled a multifaceted evaluation of the study. Accordingly, the drawings were primarily coded and named according to their environmental attitude values. For example, the drawing coded Y-7 in Figure 2 is by a student with a high environmental attitude. In the Y-7 drawing, the student highlighted the problems of fire, water pollution from waste dumped into the sea, soil pollution from garbage, air pollution from smoke emitted by factory chimneys, and noise pollution from two people speaking loudly. The student numbered their drawings and provided the following text: "1. A stream polluted by factory waste. 2. Not throwing garbage in the trash. 3. Factory smoke and noise pollution. 4. Burning and cutting down trees and the problem of clean air. 5. Noise pollution and throwing garbage on the ground." In conclusion, the student addressed multiple environmental pollution issues in their drawing. Along with their textual interpretation, this shows that the student was able to align the multifaceted and interrelated nature of environmental problems with their drawing, demonstrating a high level of awareness.

Figure 2 ***Example of an environmental problem in a drawing (Y-7)***

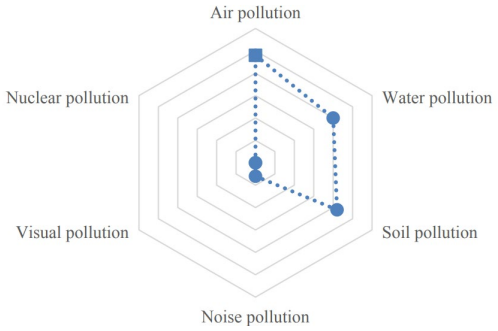


In the following sections, each theme is discussed under a separate heading. First, radar graphs for the sub-dimensions shown in the drawings are provided. Afterwards, the findings under each theme were evaluated by including student drawings and students' direct statements, accompanied by their codes. Presented below are the themes and the dimensions under each theme, analyzed in order.

3.1. Findings Related to the Environmental Pollution Dimension

Environmental pollution is one of the dimensions students most often include in their drawings. Within the dimension of environmental pollution, the sub-themes are air pollution, water pollution, soil pollution, noise pollution, visual pollution, and nuclear pollution. The radar graph of the intensity of these sub-themes in the drawings is given in Figure 3.

Figure 3 ***The extent to which environmental pollution sub-dimension is included in the drawings***



When Figure 3 is analysed, it can be observed that students included air, water, and soil pollution in their drawings related to the environmental pollution dimension. Noise pollution was rarely included in the drawings. Visual and nuclear pollution issues were not encountered in the drawings.

Drawing description of the student coded O-9 (Figure 4):

> "First of all, the smoke from factories worsens the air and leads to a bad climate. If we dump glass at the base of trees or in forests, a fire can start from that glass. Factory waste can enter the sea and destroy marine life. Cars also make loud noises, contributing to noise pollution. Smoke from cars also causes climate change. Let's protect nature."

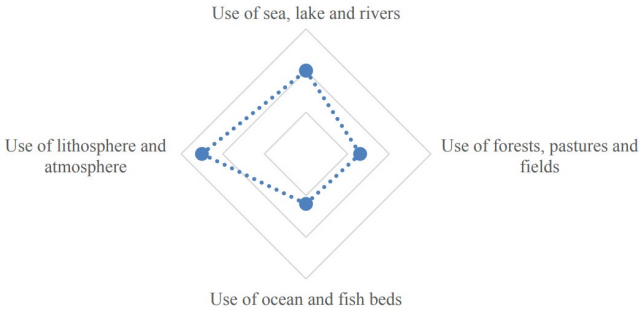
Figure 4 ***Example of noise pollution drawing (O-9)***

According to the analysis of the student's drawing, the honking of cars on the road was used to convey noise pollution. It was also observed that the student depicted more than one form of environmental pollution in his drawing. The drawing depicts water pollution caused by the release of industrial waste into the ocean and the extinction of marine fish. The fact that glass waste thrown into wooded areas, when heated, causes fires and contributes to soil pollution, while factory fumes and exhaust gases contribute to air pollution. At the same time, it is noticeable that the clouds are crying and unhappy, and the sun has a sad expression.

3.2. Findings Related to the Natural Resource Utilisation Dimension

Natural resource utilisation is one of the dimensions students most often include in their drawings. The dimension of natural resources includes the sub-themes of the use of seas, lakes, and rivers; the use of forests, pastures, and fields; the use of the ocean and fish beds; and the use of the lithosphere and atmosphere. The radar graph of the intensity of these sub-themes in the drawings is shown in Figure 5.

Figure 5 ***The extent to which natural resource utilisation sub-dimension is included in the drawings***

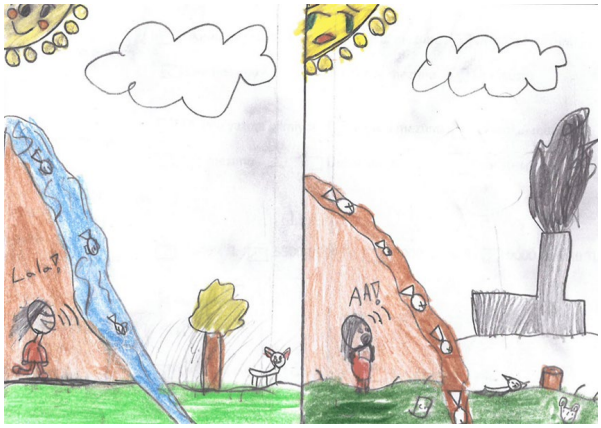


When Figure 5 is analysed, it is understood that students included all sub-dimensions of the natural resource utilisation dimension in their drawings. The use of fields, pastures, and forests, as well as the ocean and fish beds, is comparatively underrepresented in these drawings.

Drawing description of the student coded O-6 (Figure 6):

> "I once went to a park with a wonderful garden. Everything was sparkling. The day I wanted to go there with my family was the last day I saw that beauty. A week later, I went back with my family. By the time we got there, the fish, birds, and cats were dead in that rubbish dump. The water was no longer flowing. The trees had been cut down. My heart ached at that moment. We used some of the bags we had to collect the waste."

Figure 6 ***Example of drawing the use of forest-pasture-field, sea, lake and rivers (O-6)***

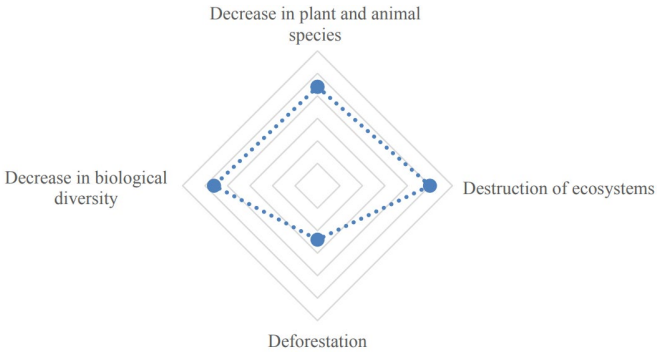


In the drawing coded O-6, the student divided the drawing area into two sections. These sections show that the student drew the same place at different times. The first part depicts the sun in the sky and a cat looking happily. It is noteworthy that the child in the picture is singing with joy. The river is blue, with many fish swimming in it; green areas and a green tree are depicted. The second part shows an environment that is exactly the opposite of the previous one. The sun is weeping, the fish and the cat are dead, the tree has been cut down, and a factory has been built in its place. The colour of the river has changed from blue to brown. The child girl is sad and surprised by what they see. When the whole drawing is analysed comparatively, it can be seen that the use of forests, pastures, and fields, as well as rivers and fish beds, is included.

3.3. Findings Related to the Flora and Fauna Dimension

The use of flora and fauna is one of the dimensions students most often include in their drawings. Sub-themes within the flora and fauna dimension include declines in plant and animal species, ecosystem destruction, biodiversity loss, and deforestation. The radar graph of the intensity of these sub-themes in the drawings is shown in Figure 7.

Figure 7 ***The extent to which flora and fauna sub-theme is included in the drawings***

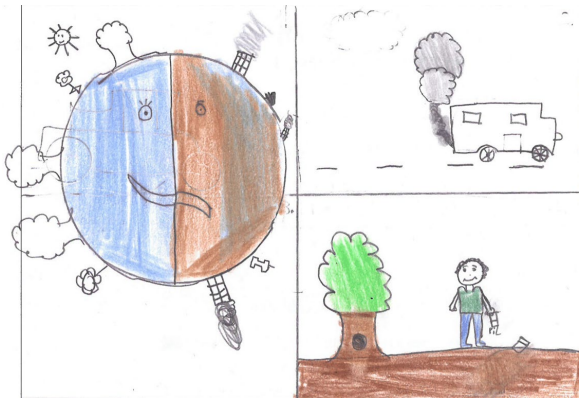


When Figure 7 is analysed, it can be observed that students included all the themes under the flora and fauna dimension in their drawings. However, it is noted that drawings on deforestation are fewer than those on the other themes.

Drawing description of the student coded O-7 (Figure 8):

> "I wanted to express the environmental pollution in my drawings."

Figure 8 ***Example of a deforestation drawing (O-7)***

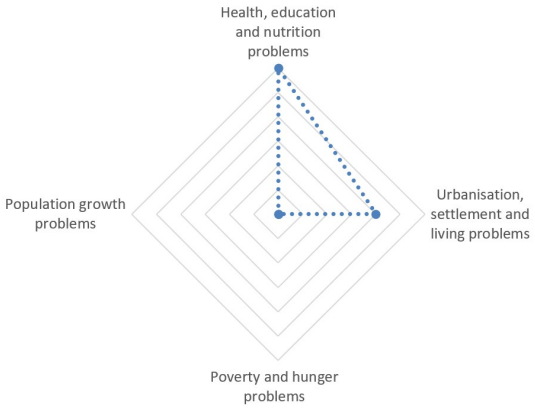


In the drawing coded O-7, the student divided the drawing area into three sections. In the first section, the Earth is divided in two, and there are drawings that could be interpreted as representing the absence and presence of environmental pollution. According to this drawing, while the clean side of the Earth is happy, blue, and has plenty of trees and plants, the polluted side shows that the plants have disappeared and the Earth has become treeless. The fact that this half of the Earth is unhappy and brown emphasises the consequences of environmental pollution. It is clear from the drawings that environmental issues like pollution and deforestation are depicted in this image. In other sections, the exhaust fumes emitted by a bus and a drawing of a child throwing battery waste into the soil draw attention. It is evident that the student is aware that car exhaust emissions cause air pollution and battery waste left in nature causes soil pollution.

3.4. Findings Related to the Social Dimension

One theme that appears less frequently in student drawings is the social dimension of environmental issues. Sub-dimensions under the social dimension include health, education, and nutrition problems; urbanisation, settlement, and living problems; poverty and hunger problems; and population growth problems. The radar graph of the intensity of these sub-themes in the drawings is shown in Figure 9.

Figure 9 ***The extent to which social dimension is included in the drawings***



When Figure 9 is examined, it is observed that the student drawings include themes related to health, education, and nutrition problems; urbanisation; settlement; and living problems within the social dimension. On the other hand, the themes of poverty, hunger, and population growth problems were not found in any of the drawings.

Drawing description of the student coded Y-8 (Figure 10):

> "Everyone throws rubbish on the ground that harms animals. They throw chemical waste, they don't know that they are going to get sick at the end of it, and they do not realise the importance of animals. We warn them, but they keep doing the same thing. Do not harm anything if you are aware of this."

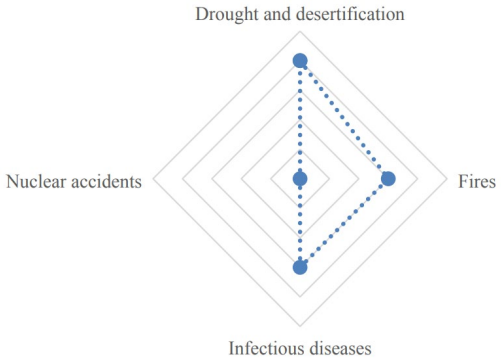
Figure 10 ***Example of drawing health, education and nutrition problems (Y-8)***

When the drawing coded Y-8 is analysed, it is observed that people pollute their environment, harming nature, people, and animals. The characterisation of fish as 'dead fish' is a result of this situation. It is also noteworthy that the sun and clouds are drawn as unhappy and sick. The fact that the clouds make a coughing sound and their colours are painted green, red, and brown to reflect their diseased states supports awareness of environmental problems that cause health problems. In the drawing, the person on the far left side is also remarkable. The person here is painted yellow; their pupils are larger than usual, in black and red; their shoulders are low; their facial expression is unhappy; and their hands are tied in front of them, as if they were suffering from abdominal pain. All these depictions point to the health problems caused by environmental issues for humans. The other people in the picture appear to be laughing and have a very cheerful, unconcerned attitude, despite throwing trash into the environment.

3.5. Findings Related to the Natural and Human Disasters Dimension

The natural- and human-disaster dimensions of environmental problems appear less commonly in student drawings. The natural and human disasters dimension includes the sub-themes of fires, drought and desertification, nuclear accidents, and infectious diseases. The radar graph of the intensity of these sub-themes in the drawings is shown in Figure 11.

Figure 11 The extent to which natural and human disasters sub-theme is included in the drawings



According to Figure 11, the themes of drought and desertification, fires, and infectious diseases in the natural and human disaster dimension were observed with similar frequency in student drawings, whereas drawings related to nuclear accidents were not found in any student drawing.

Drawing description of the student coded O-10 (Figure 12):

> "Factory: factory fumes cause air pollution, but there is a solution. We can prevent it by installing filters. Sound: Car and other vehicle noise causes sound pollution, and the solution is to make less noise. Soil: Some waste is mixed into the soil, causing soil pollution. Recycling bins are used for this. Water: People throw rubbish into the sea, and this causes water pollution. Therefore, we have to adapt people, we have to recycle."

Figure 12 Example of drought-desertification drawing (O-10)

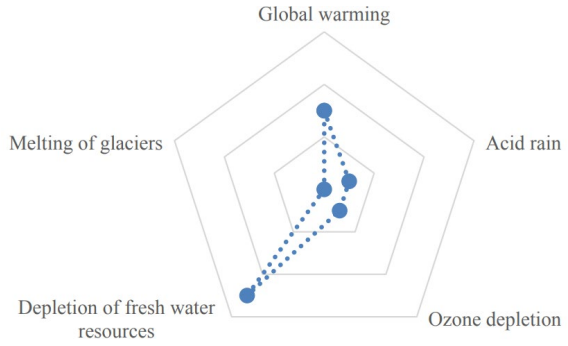
In the drawing coded O-10, it was determined that the student divided the relevant area into four parts and drew a different environmental issue in each part. In the section where the smoke from factories and chimneys, along with the surroundings, is rendered in grey and black tones, air pollution is described. In the section with the drawing of the sound rising from the cars, noise pollution, the section with the garbage thrown on the ground expresses soil pollution. It is evident that the student depicted a brown, plant-free land in the upper-right corner. The presence of a withered tree with only branches left also catches the eye. The student depicts that the land has become infertile and no

plant can survive. Therefore, this drawing shows that the student is aware of the problems posed by drought and desertification.

3.6. Findings Related to the Climatic Dimension

The climatic dimension of environmental problems appears less frequently as a theme in student drawings. The climatic dimension has sub-themes including global warming, acid rain, glacial melting, ozone depletion, and freshwater resource depletion. The radar graph of the intensity of these sub-themes in the drawings is shown in Figure 13.

Figure 13 ***The extent to which climatic sub-theme is included in the drawings***



When Figure 13 is analysed, it is evident that students included themes of global warming, acid rain, ozone depletion, and freshwater resource depletion in their drawings. While it was determined that the theme of freshwater resource depletion was drawn more frequently than other themes, drawings related to melting glaciers were not included in any student drawings.

Drawing description of the student coded D-2 (Figure 14):

> "Smoke from factories, car exhausts, etc., damages the ozone layer."

Figure 14 Example of ozone layer depletion (D-2)

The student who made the drawing, coded D-2, is seen to have included a specific region of the Earth and described it as a "garbage island" by leaving a gap in the ocean. The presence of various objects as well as stars in the vacuum of space is another striking feature. The presence of a grey layer surrounding the Earth also draws attention. The student explained this layer as follows: "Smoke from factories, car exhausts, etc., damages the ozone layer." Based on the student's expression and drawing, it was determined that the student was aware of the thinning of the ozone layer. It was seen that the student explained the entities in the drawing with the expressions 'space garbage' and 'garbage island'. Based on these expressions and the drawing, the student is aware that sea and air pollution threaten the Earth.

4. Discussion

Many environmental issues affecting our planet have emerged from human behavior. Environmental problems such as global warming, biodiversity loss, environmental pollution, and extreme natural events are just a few examples (Al-Ghussain, 2019; IPCC, 2021; Nerem et al., 2018). It is also humans who need to take action to solve all these problems. For this, environmental awareness must be instilled from an early age. Numerous studies show that as people age, their environmental awareness, interest in nature, and likelihood of forming lasting bonds with nature decrease (Chacko, 1998; Holden, 2007; Neurohr et al., 2023; Otto et al., 2019; Rosa et al., 2018; Spiteri, 2021; Torkar et al., 2020). With this perspective in mind, this study was conducted with 3rd-grade primary school students. Ultimately, in order to eliminate problems, it is necessary first to identify existing ones and then to implement appropriate interventions (Richardson et al., 2020). In this context, the aim was to identify 3rd-grade primary school students' perceptions of environmental issues through their drawings.

When examining the drawings by the participating students, it was observed that they depicted many environmental issues in detail. In some drawings, multiple issues, such as air pollution and species extinction, appeared simultaneously. In this respect, the students' drawings were detailed and realistic. Yavuzer (2011) states that in children's drawings during this period, objects and colors are not chosen randomly but are done so in accordance with reality. It is also noted that during this period, each child processes their internal relationship with their environment and its components through their drawings. Based on this, it can be inferred that primary school students hold certain ideas and mental models about environmental issues.

Looking at the environmental problems depicted, it is apparent that the students illustrated realistic, everyday objects appropriate to their developmental stage. According to Coles (1992), a child who draws is a child who thinks. What they draw reflects what they know. Therefore, the drawings in this study reflect the students' ideas about environmental issues, their awareness, and the emotions and imagery these issues evoke. Thus, the students seem to have some knowledge and awareness of environmental issues. However, this knowledge is mostly limited and superficial, focusing on basic types of pollution, waste disposal, and local environmental problems (Banks & Taylor, 2025; Häikiö, 2020). Another finding is that the students believe environmental pollution is always caused by others. The statement from student Y-8, "Everyone throws trash on the ground and harms animals. They dump chemical waste and don't realize that this will make them sick or how important animals are. We warn them, but they keep doing it. If you know this, don't harm anything," supports this idea. The belief that environmental pollution is always caused by others poses a major obstacle to taking sufficient responsibility in solving problems. Similarly, many studies have shown that people who do not see themselves as part of nature tend to be less inclined to take action on environmental issues. Connection with nature plays a significant role in the development of environmentally friendly behaviors (Bezeljak et al., 2023; Otto & Pensini, 2017; Schultz, 2007). Another striking point is that while the students illustrated environmental issues in their drawings, very few offered solutions to these problems. In a similar study, Membiela, Nougueiras, and Suarez (1993) found that students could not grasp solutions such as reuse and recycling for solid waste problems, and were insufficient in taking preventive measures. In the drawing coded O-10, the student wrote, "Factory: factory emissions cause air pollution, and there is a solution for this. We can prevent it by installing filters," indicating that some of the children can establish cause-and-effect relationships. However, in contrast, certain studies have shown that although students may have opinions on solving

environmental problems, they do not reflect much on the underlying causes (Van Harskamp et al., 2024; Wardekker, 2001).

Many speech elements are present in the drawings. These expressions often reflect emotional characteristics, such as in the drawing coded D-3, where a fish is depicted as saying, "Stop throwing things, I'm dying," and indicate that the children empathize with living beings and nature. Similarly, in drawings depicting environmental pollution, crying suns, coughing clouds, unhappy humans, animals, and plants stand out. In parallel, Sadık et al. (2011) also found that children, through their drawings, establish emotional bonds with the environment and express their awareness and the emotions environmental issues evoke in them. Yavuzer (2011, p. 78) also states that children reflect their feelings and thoughts in their drawings by placing themselves in the position of objects, drawing on emotion and intuition, thereby bridging the gap between their own experiences and their illustrations. Likewise, numerous other studies emphasize that emotions play a role in creating awareness and values (Block et al., 2019; Manni et al., 2017).

While some environmental issues were commonly illustrated in the student drawings, others were rarely depicted or not depicted at all. The most commonly illustrated environmental issue was "environmental pollution." This outcome is thought to be related to the children's limited experiences with nature (Clayton et al., 2017). In a similar finding, Littledyke (2004) concluded that children generally perceive environmental issues as littering. The reason for this may be the unpleasant appearance of garbage and frequent reminders at home and school to dispose of trash properly. Moreover, regular exposure to air, water, soil, and noise pollution in daily life, along with the negative impacts of urban living, may heighten awareness of these forms of pollution. It is also believed that the children's experiences of city life and their disconnection from nature are reflected in their drawings. Ultimately, experiences in nature influence environmental actions and awareness (Cagle, 2018; Chawla, 2020; Krapp, 2002; Nisbet et al., 2009). Similarly, Koraş (2019) found that students had greater knowledge of and opinions about local environmental issues in their living areas. On the other hand, the students rarely included global environmental problems in their drawings. For example, the issue of "decreasing freshwater sources" was mostly observed in drawings by students with high attitude levels. The problem of "melting glaciers" was not illustrated at all. It is thought that these issues, being global rather than local, are not commonly encountered in everyday life, are shaped over the long term, and are thus difficult to observe, which may explain their absence in the drawings. Indeed, Şahin (2022) also found that students had greater awareness and ideas about their immediate surroundings, likely due to more opportunities to observe their local environments compared to the global environment. The environmental objectives in the primary school curriculum may also play a role in this situation (Fraser et al., 2015; Price et al., 2019). The following learning objectives in the 3rd-grade curriculum may have led students to create more drawings about environmental pollution:

- Actively takes part in keeping their environment clean,
- Discusses the environmental damage caused by battery waste and what should be done about it (MoNE, 2018b).
- Takes responsibility for protecting nature and the environment,
- Gives examples of how recycling benefits both themselves and their environment (MoNE, 2018a).

Indeed, the fact that none of the learning outcomes related to visual/light pollution introduced starting in 4th grade (MoNE, 2018b) appeared in the student drawings or expressions supports this

assumption. Similarly, due to the content of the primary school curriculum, the students may have limited knowledge about environmental issues such as “nuclear accidents” or “drought.” Studies indicate that environmental education increases knowledge and awareness and affects environmental behavior (Fraser et al., 2015; Price et al., 2019).

Alım (2006) states that the content of environmental topics in the curriculum should be revised and expanded. Similarly, Pala (2024) emphasizes that effective environmental education programs can lead to changes in students' lives. Environmental education and being immersed in nature foster positive environmental behaviors and actions (Braun & Dierkes, 2017; Kaiser et al., 2008; Liefländer & Bogner, 2014). Based on this, it is possible to raise conscious generations through education; individuals who are aware of their environment, feel like a part of nature, possess green skills, and seek solutions to environmental problems. Education plays a key role in addressing environmental issues and preventing environmental threats from becoming disasters.

In summary, when students’ drawings are examined by their levels of environmental attitudes, certain similarities emerge among the high-, medium-, and low-attitude groups. Students in the high-attitude group tend to draw more detailed interpretations and representations of the environment, while students in the low-attitude group focus on common themes. However, despite these tendencies, common themes among the three groups suggest that they may be shaped by similar living environments and similar environmental stimuli. This finding supports the view that early environmental awareness is influenced by emotional tendencies, living culture, and school education.

4.1. Limitations and Future Directions

The present study is limited to the drawings of 30 students enrolled in the 3rd grade of primary school. The students’ awareness of environmental issues was evaluated solely from their drawings.

5. Conclusion

As a result of the study, it was observed that the students often depicted multiple environmental problems in a single drawing and that their illustrations and explanations were detailed. It was clearly evident from the drawings and accompanying narratives that the students felt unhappy about environmental issues. In the student drawings, some environmental problems were depicted extensively, while others were only partially represented or not illustrated at all. Based on this, it can be stated that the students possess a certain level of knowledge and awareness about environmental issues. However, this knowledge mostly pertains to environmental problems that are observable in their immediate surroundings, frequently encountered, and generally considered superficial. Furthermore, many students believed that others polluted the environment, which appeared to lead to a passive attitude toward solving environmental problems. In contrast, albeit rarely, some students not only expressed discomfort with environmental issues but also proposed solutions to address them.

Therefore, it is evident that the curriculum needs to be reviewed and redesigned to ensure that students acquire holistic environmental awareness. In this regard, the curriculum should include visual representations of global environmental problems to attract students’ visual attention and enhance their knowledge; practical and theoretical knowledge should be fostered through a combination of drawing, storytelling, and drama; and activities should be designed to raise awareness of local and global environmental issues. The present study demonstrates that environmental education from the very first stage of schooling is crucial for raising environmentally conscious children. The findings once again highlight the importance of guiding children from an early

age to understand and appreciate nature and the environment, to develop a sense of environmental responsibility, to feel like part of nature, and to adopt the principles of sustainability.

6. Declarations

6.1. Author Contributions (CRediT)

Author 1 (Tansu Kahvecioğlu): Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing – original draft; Writing – review & editing; Visualization.

Author 2 (Ayşenur Gündüz): Conceptualization; Methodology; Validation; Supervision; Project administration; Writing – review & editing.

6.2. Conflict of Interest

The authors declare that they have no known competing financial interests, institutional affiliations, or personal relationships that could have appeared to influence the work reported in this paper.

6.3. Funding Statement

This research received no external funding.

6.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

6.5. Ethics Approval

Ethics committee approval was obtained from Erciyes University Social and Human Sciences Ethics Committee. Permission for the research application was obtained from the Kayseri Provincial Directorate of National Education. Parental consent forms were obtained from all participants.

6.6. Use of Artificial Intelligence (AI) Tools

None

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Blended mobility in teacher education: Policy frameworks and institutional practices from the Austrian context

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ABSTRACT

This article examines how blended mobility was implemented in initial teacher education at PH Wien within the framework of Austria's Higher Education Mobility and Internationalisation Strategy 2030 (HMIS2030). Using a qualitative, descriptive embedded case study design, the study analyses two blended school placement models at PH Wien: a pilot project in Crete and a sustained, curriculum-integrated implementation between 2021 and 2025. The data consist of aggregated institutional records and policy and programme documents, which were organised through a standardised six-dimensional template and analysed descriptively. The analysis focuses on documented features such as virtual preparation, short physical placement, curriculum integration, partnership structure, and policy alignment. The findings show that in the PH Wien cases, blended mobility was organised as a practicum-embedded and curriculum-recognised format that combined short physical school placements with virtual preparation or collaboration. The available records also indicate growth in participation and diversification of destinations across terms. Rather than demonstrating student-level outcomes or equity effects, the study documents how one university college of teacher education translated a national blended-mobility agenda into institutional arrangements within the structural conditions of teacher education. The study is limited by its single-institution focus, reliance on documentary and aggregated data, and lack of direct evidence on learning outcomes, perceptions, or classroom practice. Nevertheless, it offers cautious implications for institutions and policymakers seeking to design short-term international formats that fit existing teacher-education structures.

KEYWORDS: Blended mobility; Erasmus+; Higher education policy; Internationalisation; Teacher education

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1. Introduction

International mobility is an important part of teacher education, but participation in long-term study-abroad programmes can be difficult for some student teachers because of programme structures, practicum schedules, and personal responsibilities. In parallel, internationalisation in higher education has become more complex in recent years. As Liu and Gao (2022) argue, these pressures accumulated over time rather than emerging abruptly and were already visible before COVID-19 (e.g., geopolitical tensions, nationalism/populism, and anti-integration trends such as Brexit).

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The outbreak of COVID-19 significantly disrupted traditional patterns of physical student mobility. In response, virtual mobility (VM) gained greater visibility and use in higher education (Wang & Sun, 2022). This shift supported the wider use of hybrid formats that combine short physical mobility with structured online elements, including blended mobility. In the European policy context, blended mobility (BM) refers to a format that combines a physical mobility period with a structured virtual component before, during, or after the stay (European Commission, 2022). Virtual and blended mobility are increasingly discussed in European policy as part of a "mobility for all" agenda, with a focus on widening access and supporting flexible participation through digital components alongside physical mobility (Rajagopal & Mateusen, 2021). This policy direction also frames Austria's national strategy on mobility and internationalisation.

In Austria, this policy direction is reflected in the Higher Education Mobility and Internationalisation Strategy 2030 (HMIS2030) (BMBWF, 2020). The strategy presents internationality as a guiding principle for higher education institutions, promotes "mobility for all," and encourages the meaningful use of digital tools and innovative blended formats alongside physical mobility to support cross-border academic dialogue and intercultural learning. In this study, HMIS2030 serves as a policy reference for examining how the documented features of PH Wien's (Pädagogische Hochschule Wien-University College of Teacher Education Vienna) blended mobility models relate to national priorities, rather than for assessing policy effectiveness.

In teacher education, long-term physical mobility can be difficult to fit into practicum-based programmes and fixed study calendars. Schön and Sliwka (2014, p. 85) noted the relatively low mobility of prospective teachers. In this context, blended mobility is often discussed as a flexible alternative that links online collaboration with a short physical stay. Based on practice-based accounts, Perfölz and López-Varela (2022) suggest that digital exchange can provide a low-threshold entry point for students who cannot participate in long-term mobility, while short physical components may support motivation and cooperation. They also argue that digital preparation and follow-up communication can make face-to-face exchange more sustainable over time, although implementing blended mobility still requires substantial institutional effort and involves organisational, technical, and policy-level challenges.

Despite growing interest in hybrid and blended mobility formats, there remains limited empirical and practice-oriented research on how blended mobility is designed and implemented in teacher education programmes across different national contexts. Recent discussions of blended mobility suggest that it may support flexibility and broaden access to international experience, especially for students who may not be able to participate in traditional long-term physical mobility (e.g., O'Dowd, 2022; Perfölz & López-Varela, 2022). However, fewer studies provide detailed institutional examples from teacher education that describe practicum-embedded blended school placements and their documented design features. This study addresses this gap by examining Austria as a context where HMIS2030 encourages innovative digital and blended mobility approaches.

To clarify the institutional context of this study, we briefly describe the practicum structure at PH Wien. PH Wien is a university college of teacher education in which the school practicum is a mandatory, tightly scheduled component of pre-service preparation. Practicum periods are organised within fixed programme calendars and partner-school arrangements, which can limit long-term mobility but also support short, curriculum-recognised placements when aligned with practicum requirements.

Using documentary sources and aggregated institutional records, this study examines two illustrative blended school-placement models at PH Wien in initial teacher education (i.e., pre-service teacher

education before entry into the profession): a pilot school-placement project and a sustained, curriculum-integrated implementation. It documents how blended mobility has been operationalised at PH Wien and highlights design-relevant features such as virtual preparation, the short physical placement, practicum embedding, and curricular recognition. Based on documentary evidence, it also maps the documented features of these models to HMIS2030 goals (BMBWF, 2020) to show how a national policy agenda is reflected in institutional practice, without claiming individual learning outcomes or equity effects. Accordingly, the study addresses two research questions:

(1) How has blended mobility been implemented in initial teacher education at PH Wien?

(2) How do the documented features of PH Wien's blended mobility models relate to HMIS2030 goals, as evidenced in policy and institutional documents?

2. Theoretical Foundations of BM in Teacher Education

2.1. Conceptualising Blended Mobility: Definitions and Scope

Blended Mobility (BM) refers to an intentional combination of physical mobility and a virtual learning component in international education. In the Erasmus+ 2021–2027 framework, BM is defined as a mobility format in which the virtual component takes place before, during, and/or after the physical period (European Commission, 2022).

At the same time, the literature also stresses the continued value of physical mobility. Even with virtual and hybrid options, many scholars argue that in-person mobility remains important for deeper intercultural communication and immersion experiences (Širca et al., 2024). For this reason, BM is often described as a complementary approach rather than a replacement for physical exchange. In this sense, BM is discussed as a way to support participation for "fewer opportunity students" who may face barriers to long-term mobility (Bauer & Kartsonakis, 2023).

2.2. Theoretical Perspectives on Blended Mobility

Understanding BM also requires clear distinctions between related concepts such as virtual exchange (VE) and virtual mobility (VM). In this paper, these concepts provide a simple lens for describing and interpreting the design of BM in teacher education, especially the balance between online collaboration and short physical placements. This helps us explain how the PH Wien models combine virtual and physical elements in documented ways.

2.2.1. Virtual Exchange (VE)

Virtual exchange (VE) is an online learning approach in which students work with peers from other countries as part of a course, under the guidance of teachers or trained facilitators. VE involves technology-mediated interaction and a student-centred, collaborative learning process, with a strong (but not exclusive) focus on soft skills and intercultural competence (O'Dowd, 2022). VE differs from virtual mobility in a key way: VE emphasises structured interaction and intercultural learning, while virtual mobility more often refers to accessing courses or materials from a foreign institution without direct peer interaction or explicit intercultural learning goals (Helm & O'Dowd, 2020).

2.2.2. Virtual Mobility (VM)

In the Erasmus+ Programme Guide, the European Commission defines virtual mobility (VM) as "a set of activities supported by Information and Communication Technologies, including e-learning, that realise or facilitate international, collaborative experiences in a context of teaching, training or learning" (European Commission, 2019, p. 327). O'Dowd (2022) explains that VM can include students who join online collaborative projects with international peers within their home curriculum and students who take online courses offered by a foreign institution for academic credit. Sabzalieva

et al. (2022) note that VM can enable international experience without travel and may be useful for students who face financial, physical, or social barriers, including students with disabilities, students with migrant or refugee backgrounds, and students with limited resources or caring responsibilities. To provide a stronger intercultural learning experience, VM often needs deliberate course design and support, and it can benefit from links to virtual exchange approaches (O'Dowd, 2022).

2.2.3. Blended Mobility (BM)

In teacher education, BM is often discussed as a way to support international learning in more flexible formats. In teacher education, structural barriers can be strong. For example, Schön and Sliwka (2014) note that language-related constraints are important because teacher education is usually tied to the official language of national school systems, which can limit long-term mobility unless students pursue bilingual routes. In this context, BM is described as an accessible entry point that can help students start international engagement through virtual preparation and a short physical stay (Perfölz & López-Varela, 2022). O'Dowd (2022) adds that BM can support cross-border collaboration online and in person, helping students build relationships with peers and instructors. Sabzalieva et al. (2022) place BM between virtual and physical mobility and stress its adaptability to institutional capacity and student needs. In teacher education, such blended formats are discussed as one way to support intercultural competence and global awareness, which are relevant for future teachers in diverse classrooms (Brück-Hübner et al., 2024). In the empirical part of this paper, these distinctions (VE, VM, and BM) serve as a lens for describing how BM was designed and documented in the PH Wien cases. Table 1 serves as a descriptive guide to distinguish common activity types across VE, VM, and physical mobility (PM), and to clarify the building blocks that may be combined in blended mobility designs.

Table 1 ***Comparative Overview of Activities in Virtual Exchange (VE), Virtual Mobility (VM), and Physical Mobility (PM)***

Activities in VE	Activities in VM	Activities in PM
Team introductions and presentations of institutions	Online lectures (live or recorded)	Lab sessions + Fieldwork
Synchronous/asynchronous discussions on course content	Interactive polls and quizzes	Intensive group work
Comparison of cultural and national perspectives	Reading/viewing materials with annotation tools	Presentation of online project outcomes
Initial phase of collaborative group work	Online tutorials with instructors	Cultural activities and campus visits

Note. Adapted from O'Dowd (2022, p. 21). Table 1 shows common activity types in virtual exchange (VE), virtual mobility (VM), and physical mobility (PM). VE and VM mostly involve online interaction and learning. PM includes on-site learning, hands-on work, and cultural activities. The table is only a descriptive guide. It does not evaluate outcomes.

2.3. Policy Strategies for BM in Teacher Education

BMBWF (2020) sets out national objectives for mobility and internationalisation and explicitly mentions innovative formats, including virtual and blended options. The strategy can be read alongside wider European policy discussions on digitalisation, intercultural dialogue, and wider access to international learning. In this paper, HMIS2030 is used as a policy framework to describe how documented institutional features relate to national priorities, rather than to assess policy impact.

Despite growing efforts through recommendations and working papers, policy documents focused solely on the internationalisation of teacher education remain limited in Europe (Nierste, 2024). In Austria, HMIS2030 sets out five strategic goals and invites institutions to select objectives based on their profiles and starting points. In this paper, these goals serve as reference points for describing policy alignment, which is supported by documents, without claiming policy effectiveness.

1. HMIS2030-1 (All-encompassing culture of internationalisation). Emphasises institution-wide internationalisation through strategy, stable structures, resources, and quality management. It also promotes internationalisation of the curriculum and Internationalisation at Home (IaH), and states that IaH cannot replace mobility abroad.
2. HMIS2030-2 (Mobility for all). Frames mobility as a core element of internationalisation and aims to widen participation, with attention to underrepresented groups. It also highlights trainee teachers and doctoral students and supports more short and non-traditional formats.
3. HMIS2030-3 (Innovative digital forms of mobility). Promotes virtual and blended mobility as a complement to physical mobility, not a replacement, and identifies enabling conditions such as digital infrastructure and a willingness to experiment.
4. HMIS2030-4 (Effective skills improvement and institutional learning). Stresses clear objectives, curricular integration of skills, quality-assured processes, preparation and follow-up, recognition, and institutional learning linked to quality management.
5. HMIS2030-5 (Global mindset and Austria's position in the world). Focuses on Austria's international positioning, especially for non-EU citizens, and highlights reducing bureaucracy, improving procedures, supporting grants, strengthening alumni links, and improving visibility.

Taken together, these goals outline the national policy frame within which institutions may design and describe mobility measures. Consistent with the HMIS2030 logic, any "policy alignment" in this study is attributed only where it is supported by institutional documentation or aggregated records, rather than inferred as an effect or outcome.

2.4. Blended Mobility as a Pedagogical and Inclusive Practice in Teacher Education

Survey evidence from the Erasmus+ Higher Education Impact Study suggests that participants most often report motivation to experience life abroad (70%) and improve language skills (62%). In contrast, non-mobile students often mention financial concerns (around two-thirds) and personal or family reasons (around one in two) as barriers to mobility (CHE Consult & ICF Consulting, 2019). In this context, blended mobility (BM) is often described as a flexible format that combines online collaboration with a brief in-person visit. The literature presents BM as a design option that may support access for students who cannot join long-term mobility, including "fewer opportunity students" (Bauer & Kartsonakis, 2023). It can include preparation and follow-up activities that help connect the online and in-person parts of the experience, but it also requires institutional effort and coordination (Perfölz & López-Varela, 2022). This inclusion-oriented framing is also linked to Internationalisation at Home, which aims to integrate international and intercultural dimensions into the curriculum for all students (Beelen & Jones, 2015).

BM formats are often described as a way to combine short physical mobility with virtual collaboration, so that mobility can better fit students' schedules and responsibilities (Perfölz & López-Varela, 2022). However, whether BM reduces barriers or improves equity depends on local implementation and is not evidenced by the present study.

Practice-based accounts from blended-mobility projects report positive student reception. For example, based on project experience and informal feedback in the blended AIM project, Welzera et al. (2020) note that students perceived the blended format positively and that the virtual component can support experience in remote collaboration and communication. Beyond perceived value for participants, the literature also discusses hybrid and blended mobility as a format that may support access for students who cannot undertake long-term physical mobility (Širca et al., 2024). In addition, some authors argue that hybrid designs may reduce the financial burden of mobility by limiting travel distance and time abroad, although costs and outcomes depend on programme design (Tibelius & El Allame, 2023).

3. Method

3.1. Research Design

The study adopts a qualitative, descriptive embedded case-study design focusing on PH Wien. Within this institutional case, two BM models were analysed as embedded cases: (i) a pilot school-placement project and (ii) a sustained, curriculum-integrated implementation between 2021 and 2025. The two models were examined using the same document-based criteria and were summarised and compared across the two cases. To link policy and practice, BMBWF (2020) served as a reference for document-based extraction and policy mapping (see "Policy alignment" below), not as a measure of policy impact. Consistent with embedded case-study logic, the models were described across key dimensions, including virtual preparation and mentoring, short physical placement, curriculum integration and ECTS recognition, and partnership structure (Yıldırım & Şimşek, 2018).

3.2. Context and Inclusion/Exclusion Criteria

The empirical focus of the study is PH Wien, situated within the Austrian teacher-education ecosystem. Within PH Wien, we identified two BM models using document-based selection criteria. A model was included if institutional documents or aggregated records explicitly indicated (i) relevance to initial teacher education, (ii) a virtual component combined with a short physical placement, (iii) curricular recognition or formal linkage to practicum requirements (e.g., ECTS recognition or stated integration into teacher training), and (iv) implementation within the 2021–2025 period covered by the available records. Activities were excluded if they lacked either the virtual or the physical component, fell outside the 2021–2025 period, or targeted only in-service teachers, administrative staff, or continuing professional development.

3.3. Data Sources and Collection

3.3.1. Access to institutional records

Aggregated, non-identifiable records were obtained from PH Wien (with permission) for 2021–2025 and used in accordance with institutional approval. The records were aggregated at the term level and included counts of participating student teachers and destination regions, as reported in the institutional data used for Table 4. No individual-level data were processed. The records did not include personal characteristics (e.g., gender, socio-economic background, disability status), nor did they include direct evidence on individual learning outcomes or classroom practice.

3.3.2. Purposive web search

A purposive document search (2018–2025) in English and German identified relevant national policy texts and institutional documents relating to HMIS2030 and PH Wien's internationalisation strategies. Document types included strategy and policy texts, institutional webpages, programme descriptions, and internal reports. Documents were included if they contained explicit information

relevant to blended mobility in teacher education (e.g., programme rules, stated design features, recognition/ECTS information, or references to HMIS2030 priorities).

3.4. Analytic Approach

The analysis was descriptive, consistent with the documentary and aggregated nature of the data; no causal interpretations or statistical inference were attempted. First, we compiled the document set and aggregated records for 2021–2025. Second, we extracted only document-supported information into a six-field template (virtual preparation and mentoring; short physical placement; curriculum integration and ECTS recognition; partnership structure and sustainability; documented indicators; policy alignment). Third, when information was missing or unclear, it was marked as "not documented" and was not inferred. Finally, we summarised each case in a standardised table and prepared a short document-based narrative summary. We then compared the two cases across the same fields. For policy alignment, we mapped documented features to HMIS2030 goals (HMIS2030-1 to HMIS2030-5) only where documentary support existed; where no support was available, no alignment was assigned. In the Findings section, each PH Wien model is presented in a standardised table, followed by a brief contextual paragraph based on documentary sources and aggregated records.

4. Findings

Within the Austrian policy context outlined above, PH Wien documents two blended mobility models in initial teacher education. The following subsections present two illustrative institutional cases: a pilot school-placement project and a sustained, curriculum-integrated implementation from 2021 to 2025. The aim of this section is to describe the documented design features, participation patterns, and policy-relevant characteristics of these two cases.

4.1. Pilot Blended School Placement at PH Wien (2022/23)

The Crete pilot is presented in the institutional documents as an early example of blended school placement at PH Wien, combining virtual preparation with an overseas placement. Table 2 summarises the documented features of this pilot across the six analytic dimensions.

Table 2 ***PH Wien Crete Pilot (2022/23)***

Dimension	Evidence
Virtual preparation/mentoring	Pre-departure virtual coaching; lesson plan exchange with local mentors.
Short physical placement	3-week Erasmus+ school placement in Crete (Sept 2023).
Curriculum integration/ECTS	Counted toward formal teacher training.
Partnership structure/sustainability	Partnership with Heraklion Regional Directorate; expansion plans noted.
Documented indicators	7 student teachers (2023); prior voluntary test (n=5, Südtirol 2022).
Policy alignment	HMIS2030-2 (mobility for all), HMIS2030-3 (digital formats), HMIS2030-4 (skills/institutional learning).

Note. Policy codes refer to Austria's HMIS2030 goals — HMIS2030-1: institution-wide culture; HMIS2030-2: mobility for all; HMIS2030-3: digital formats; HMIS2030-4: skills & institutional learning; HMIS2030-5: global mindset.

As shown in Table 2, preparations for the Crete pilot began in the 2022/23 winter term. In September 2023, before the start of the academic year, seven PH Wien students went to Heraklion for a three-week teaching internship at two schools, funded through Erasmus+ SMP. The available document also reports pre-departure coaching, virtual contact with mentors, and lesson-plan exchange as part of the preparation process. The internship was documented as being recognised for the students' studies. The same document further notes that an extension for February 2024 had already been agreed with the school management and that plans were in place to expand the network to other Greek, Italian, and German regions (HMIS2030, n.d.). The present data do not include participant-level characteristics such as employment status or other equity-related indicators.

4.2. Sustained, Curriculum-Integrated Blended Mobility at PH Wien (2021–2025)

The second case concerns the sustained, curriculum-integrated use of blended mobility at PH Wien between 2021 and 2025. The available documents indicate that short-term school placements abroad were implemented across multiple terms and combined with virtual preparation or collaboration elements within teacher education programmes. Table 3 summarises the documented features of this case across the six analytic dimensions.

Table 3 ***PH Wien Sustained Implementation (2021–2025)***

Dimension	Evidence
Virtual preparation/mentoring	Virtual collaboration elements embedded in programmes.
Short physical placement	Recurrent short-term placements across multiple regions.
Curriculum integration/ECTS	Aligned with practicum, calendars, student workload (programme design).
Partnership structure/sustainability	Sustained partnerships; diversified destinations across terms.
Documented indicators	Participation increased from 5 (2021–22) to 38 (2024–25); destinations broadened (see Table 4).
Policy alignment	HMIS2030-1 (institution-wide culture), HMIS2030-2 (mobility for all), HMIS2030-3 (digital formats), HMIS2030-4 (skills/institutional learning).

Note. Policy codes refer to Austria's HMIS2030 goals — HMIS2030-1: institution-wide culture; HMIS2030-2: mobility for all; HMIS2030-3: digital formats; HMIS2030-4: skills & institutional learning; HMIS2030-5: global mindset.

As shown in Table 3, the available documents describe recurrent short-term school placements abroad with curricular recognition, together with virtual preparation or collaboration elements. The same documents indicate that these placements were linked to practicum requirements, academic calendars, and student workload considerations within teacher education programmes. In this case, the emphasis is not on a single pilot, but on repeated implementation across multiple terms and destinations. Table 4 presents term-level participation figures and destination regions for 2021–2025.

Table 4 ***Number of Students Participating in Blended Mobility Programmes Coordinated by PH Wien (2021–2025)***

Year/Term	Students	Regions
2021–2022 Summer Term	5	Südtirol (Italy)

Year/Term	Students	Regions
2022–2023 Summer Term	28	Südtirol (Italy), Crete (Greece), Lüneburg (Germany)
2023–2024 Winter Term	18	Berlin (Germany), Tartu (Estonia), Crete (Greece), İstanbul (Türkiye), Toscana (Italy)
2023–2024 Summer Term	30	Berlin (Germany), Tartu (Estonia), Crete (Greece), İstanbul (Türkiye), Südtirol & Piemont (Italy), Albuquerque/New Mexico (USA)
2024–2025 Winter Term	28	Berlin (Germany), Crete (Greece), İstanbul (Türkiye), Toscana, Veneto & Piemont (Italy)
2024–2025 Summer Term	38	Berlin & Lüneburg (Germany), Tartu (Estonia), Crete (Greece), İstanbul (Türkiye), Südtirol & Piemont (Italy), Esbjerg (Denmark), Mark (Sweden)

Note. University College of Teacher Education Vienna [PH Wien], internal data, 2025.

The aggregated records show that participation increased from 5 students in the 2021–2022 summer term to 38 students in the 2024–2025 summer term. Over the same period, destinations broadened from Südtirol to a wider range of partner locations, including Berlin, Tartu, Crete, İstanbul, several Italian regions, Esbjerg, Mark, and Albuquerque/New Mexico. In this study, these records are treated as evidence of expansion across terms and diversification of destinations, rather than as proof of impact, equity, or scalability. Repeated engagement with locations such as Crete, Südtirol, Berlin, and İstanbul is also consistent with continuing institutional partnerships.

5. Discussion

The two PH Wien cases suggest that blended mobility in initial teacher education can be organised as a practicum-embedded and curriculum-recognised format. In both cases, short physical school placement is combined with virtual preparation or collaboration and linked to practicum requirements, academic calendars, and student workload considerations. In this sense, the findings do not provide evidence of student-level impact; instead, they show how blended mobility was organised within the structural conditions of teacher education.

Existing work on teacher education suggests that virtual and blended formats can support preparation, collaboration, and professional learning, but they do not remove the value of in-situ school experience. Moorhouse (2024) reports that pre-service teachers viewed a virtual teaching-abroad experience as professionally useful, while also concluding that such formats cannot fully replace sustained engagement in an overseas school context. Likewise, Symeonidis and Impedovo (2023) show that virtual exchange in teacher education depends on stable partnerships, structured student tasks, and synchronous communication, and can broaden student teachers' awareness of other education systems and cultural diversity. A different configuration appears in Europe on the Edge, where a much longer virtual phase was combined with a short and selective physical visit (Millner, 2020). Compared with these examples, the PH Wien cases point to a model in which short virtual elements accompany a practicum-linked school placement abroad rather than replace it.

In relation to the second research question, the PH Wien cases can be read as consistent with a key concern in the teacher education mobility literature: student teachers often participate less in mobility programmes than students in other fields because of practicum structures, curriculum requirements, and nationally regulated training pathways (Alexiadou et al., 2024; Ballowitz et al.,

2015; Bauer & Kreuz, 2015; Leutwyler et al., 2017). In this context, the PH Wien model is notable not for removing these structural conditions, but for working within them. By embedding mobility into practicum-linked and formally recognised formats, the cases reflect one institutional response to the national call to strengthen mobility opportunities for trainee teachers (BMBWF, 2020).

The format is also broadly consistent with policy objectives related to flexibility and wider participation. Because the placements are short-term, funded, and linked to formal study requirements, they appear designed to fit more easily with time and cost constraints than longer periods of study abroad. This reading also fits broader post-COVID discussions of blended and virtual mobility as more flexible pathways for international learning, without replacing the value of physical mobility (O'Dowd, 2022; Širca et al., 2024). Publicly visible Austrian examples from teacher education, including a blended intensive programme at the University of Vienna, also suggest that PH Wien is not alone in experimenting with such formats (University of Vienna, n.d.).

However, the present study does not identify participants by employment status, care responsibilities, or other socio-demographic characteristics, so it cannot claim direct evidence of inclusion or equity effects. Its contribution lies elsewhere: in a field where teacher-education-specific internationalisation strategies remain relatively limited (Nierste, 2024), the study documents how one university college of teacher education translated a national blended-mobility agenda into practicum-embedded institutional arrangements.

5.1. Limitations and Future Directions

This study has clear limitations. It is based on a single institutional case in one national context and draws primarily on documentary and aggregated institutional data. It does not include direct evidence on individual learning outcomes, student or mentor perceptions, or classroom practice, nor does it attempt to draw causal inferences. The analysis is descriptive, and the illustrative value of the PH Wien models is argued on the basis of policy alignment, curricular embedding, participation patterns, and documented continuity across terms rather than on systematic impact evaluation. Future research could build on this groundwork by incorporating qualitative data from students, mentors, and coordinators to explore how blended school placements are experienced in practice, and by examining questions of equity more directly for different student groups. Comparative studies across institutions and countries, as well as longitudinal designs that follow teacher candidates into their professional careers, would further deepen understanding of how blended mobility is used within the internationalisation of teacher education in both structural and pedagogical terms.

6. Conclusion

This study examined how blended mobility was implemented in initial teacher education at PH Wien within the framework of Austria's HMIS2030. Focusing on two embedded cases—a pilot school-placement project in Crete and a sustained, curriculum-integrated implementation between 2021 and 2025—it showed that short, Erasmus+-funded blended placements can be organised in ways that remain linked to practicum structures. Across the period covered by the available records, participation increased and destination patterns broadened, while the model remained anchored in school placements abroad and connected to teacher education requirements.

Conceptually, the study shows how blended mobility can be organised in teacher education through a combination of virtual preparation and short school placement abroad. More specifically, it documents how one university college of teacher education translated a national blended-mobility agenda into practicum-embedded and curriculum-recognised institutional arrangements. The study does not demonstrate learning outcomes or equity effects, but it does make visible one documented

model through which international mobility was fitted into the structural conditions of teacher education.

The findings therefore offer cautious implications for practice and policy. In the PH Wien case, blended mobility appears more manageable, as documented, when it is integrated into practicum structures, coordinated with academic calendars, supported by preparation and mentoring, and linked to formal recognition and available funding. These features may be informative for teacher-education institutions and policymakers seeking to design short-term international formats that fit existing programme structures. At the same time, further research is needed to examine whether such arrangements improve participation, equity, or educational outcomes for different student groups.

7. Declarations

7.1. Author Contributions (CRediT)

Two authors contributed equally to the design, writing, and revision of this study. Each author approved the final version of the manuscript and agrees to be accountable for all aspects of the work.

7.2. Conflict of Interest

The authors declare no financial, commercial, or personal conflicts of interest related to this study.

7.3. Funding Statement

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7.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

7.5. Ethics Approval

Aggregated, non-identifiable records were obtained from PH Wien with institutional permission and used in accordance with institutional approval.

7.6. Use of Artificial Intelligence (AI) Tools

During the preparation of this work, we used GPT-4 (OpenAI, version 5.2) only for language correction and formatting. After using this tool/service, we reviewed and edited the content as needed and take full responsibility for the publication's content.

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Special education teacher candidates' experiences and views regarding artificial intelligence use

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ABSTRACT

The growing integration of AI in educational environments underscores the need to equip future educators to use AI ethically and pedagogically. This necessity is particularly evident in special education, where personalized instruction, professional expertise, and ethical awareness are essential. This qualitative study utilized a phenomenological research approach to document participants' lived experiences. Data were gathered through semi-structured interviews with eight pre-service special education teachers who were actively engaged in school-based experiences throughout the inquiry. All interviews were transcribed verbatim and subjected to content analysis, facilitating the systematic identification of themes and subthemes. The study produced ten primary themes and twenty-five secondary themes. Results suggest that participants predominantly viewed AI as a pragmatic and beneficial resource, especially for time efficiency, the creation of instructional materials, and the accommodation of diverse learner needs. Artificial intelligence was perceived as possessing significant potential to enhance personalized learning and instructional planning within special education settings. Participants reported a lack of formal instruction in AI within their teacher education programs, stating that their understanding was largely derived from self-directed inquiry. Ethical concerns, particularly regarding data privacy, the accuracy of AI-generated information, and professional accountability, emerged as a significant subject. Participants underscored that AI should be viewed as a supplementary tool rather than a replacement for educators' professional competence and interpersonal engagement. The findings underscore the imperative of integrating structured AI literacy, ethical awareness, and practical applications into special education teacher training programs to facilitate responsible and effective AI use.

KEYWORDS: Special education teacher candidates; Artificial intelligence in education; Educational content development; Pre-service teacher education

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1. Introduction

Artificial intelligence (AI) has emerged as a transformative force in global education, offering new possibilities for personalized learning, administrative efficiency, and data-driven pedagogy. As nations embrace AI to enhance educational systems, questions surrounding access, equity, and ethics have also intensified (UNESCO, 2025a). International frameworks such as UNESCO's 2021 Recommendation on the Ethics of Artificial Intelligence and the AI and Education policy agenda call for human-centered, rights-based approaches to AI adoption in education, especially in support of

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inclusive and equitable learning environments (UNESCO, 2025b, 2025a). Yet, as AI reshapes the roles of both teachers and learners, many countries lack a comprehensive strategy to meaningfully integrate AI into teacher preparation programs (UNESCO, 2025b).

The recent proliferation of AI tools has created unprecedented challenges for teacher education worldwide, underscoring the imperative to train future instructors to successfully integrate AI-driven technologies in the classroom (Kuzu, 2025). In Türkiye, the Ministry of National Education (MoNE) has aligned with global initiatives by launching the Artificial Intelligence in Education Strategy and Action Plan (2025–2029) (MoNE, 2025). This policy outlines a comprehensive roadmap for digital transformation, including measures such as launching in-service AI training programs for teachers and implementing AI-powered accessibility solutions for students with special needs (MoNE, 2025). This policy-driven approach reflects a clear recognition of both the opportunities and responsibilities that AI brings to education, emphasizing ethical considerations and teacher capacity-building as foundations for sustainable, inclusive innovation in schools.

Within the field of special education, AI introduces unique opportunities and challenges that underscore the need for informed teacher readiness. On one hand, AI-based tools (e.g., intelligent tutoring systems and assistive technologies) have demonstrated potential to enhance learning for students with special needs by personalizing instruction and removing traditional barriers to participation (OECD, 2025). Recent developments in adaptive technologies, speech recognition systems, and intelligent tutoring software have improved opportunities for students with diverse needs (Kooli & Chakraoui, 2025). UNESCO also highlights that, when designed inclusively, AI systems can play a crucial role in enabling equitable learning opportunities for learners with disabilities by supporting accessibility and personalization (UNESCO, 2025a). On the other hand, the integration of AI in special education raises important ethical, legal, and practical concerns. Educators caution that if AI tools are used in sensitive processes without proper oversight, they may fail to meet required personalized standards or even risk student privacy violations (Arundel, 2025). Students with disabilities may be disproportionately affected by systems not attuned to their unique contexts, thereby exacerbating existing educational inequities. Addressing these challenges demands that special education teachers be adequately prepared not only to use AI tools but also to critically assess their appropriateness, accessibility, and ethical implications.

The integration of AI into special education holds substantial promise due to its capacity to individualize learning materials and support diverse learner needs (Almarzouq et al., 2025; Yaşar & Vuran, 2025). Despite this perceived potential, both pre-service and in-service special education teachers demonstrate low levels of actual AI use, largely due to limited knowledge of specific applications and uncertainty about how to integrate them effectively into instruction (Almarzouq et al., 2025; Yaşar & Vuran, 2025). In addition, the limited AI adoption is associated with systemic barriers, including inadequate technological infrastructure—such as insufficient access to smart boards, computers, and reliable internet—and insufficient training that remains largely theoretical and quickly forgotten when not applied in practice (Almarzouq et al., 2025; Çay et al., 2020; Yaşar & Vuran, 2025).

The widespread emergence of digital and AI-based technologies in educational contexts has foregrounded the question of how future teachers are prepared to adopt these tools in pedagogically grounded and ethically responsible ways. Recent research indicates that although pre-service special education teachers recognize the value of digital tools for supporting diverse learner needs, many feel inadequately prepared and lack sufficient hands-on training opportunities (Vellonen et al., 2025). Evidence further shows that their level of digital literacy strongly shapes how useful and easy

to use they perceive AI applications to be, which in turn directly influences their intention to adopt such tools in educational contexts (Yao & Wang, 2024). A recent study by Ozturk et al. (2025) reported that pre-service special education teachers perceive AI as a promising tool for assessment, diagnosis, instruction, and material development for learners with special needs, while simultaneously expressing concerns regarding ethical use, data security, and potential risks. Psychological factors also shape how pre-service special education teachers perceive and approach AI integration. For instance, Sümer-Dodur (2025) found that pre-service special education teachers' conscientiousness is closely linked to their attitudes toward AI, with AI literacy enhancing attitudes and AI anxiety reducing them. Despite growing awareness and generally positive perceptions, a pronounced gap persists between special education teachers' belief in AI's importance and their limited actual use in classroom practice (Almarzouq et al., 2025).

Artificial intelligence (AI) has rapidly become a central focus in educational research due to its potential to enhance personalized learning, adaptive instruction, and data-informed decision-making. Recent systematic reviews document the expanding range of AI applications in education, including intelligent tutoring systems, learning analytics, and associated ethical considerations (Wang et al., 2024). However, much of the existing literature concentrates on general teacher education and technological readiness, frequently emphasizing attitudes or competency measures rather than pedagogically grounded integration (Meylani, 2024). Research in special education remains comparatively limited. Studies have examined AI awareness among in-service special education teachers (Hocaoğlu, 2025) and digital competency and AI literacy levels among special education students (Vosoughmatin, 2025), yet these investigations are predominantly quantitative and do not explore how pre-service special education teacher candidates interpret and contextualize AI use within inclusive and individualized instructional settings. Similarly, research on pre-service teachers' AI use more broadly highlights efficiency gains and content generation (Çelik, 2025), but rarely addresses the distinctive pedagogical and ethical demands inherent in special education. Moreover, scholarship on AI integration in special education teacher preparation tends to foreground faculty or institutional perspectives rather than candidates' lived experiences (Kaczorowski et al., 2024). Addressing this gap, the present qualitative study examines special education teacher candidates' experiences and views on the use of AI. To guide this inquiry, the following research questions are investigated:

- What are special education teacher candidates' perceptions of artificial intelligence in educational contexts?
- How do special education teacher candidates describe their educational exposure and experiences with artificial intelligence?
- How do special education teacher candidates describe the perceived pedagogical value of artificial intelligence in special education?
- What are the challenges special education teacher candidates experience in using artificial intelligence tools?
- What are the ethical concerns perceived by special education teacher candidates in relation to artificial intelligence?
- How do special education teacher candidates envision the future role of artificial intelligence in special education practice?

2. Method

This study was designed using phenomenology, a qualitative research design. Phenomenology is a research design that aims to examine, in depth and detail, individuals' experiences related to a phenomenon, their perceptions, and the meanings they attribute to these experiences (Yıldırım & Şimşek, 2013). In this context, the study aimed to reveal participants' experiences regarding the phenomenon under investigation. Data for the study were collected using a semi-structured interview technique.

2.1. Participants and Procedure

The participants in the study were selected from undergraduate students enrolled in the Department of Special Education at XXX University. The study sample consisted of eight participants. Participants were identified using a simple random sampling technique. In simple random sampling, each individual has an equal and independent probability of being included in the study (Büyüköztürk et al., 2018). Therefore, the study employed a robust sampling method with high representativeness, in which all individuals in the population had equal and independent probabilities of selection. Table 1 shows the demographic information of the participants.

Table 1 ***Demographic Characteristics of the Participants***

Variable	Category	f	%
Gender	Female	5	62.5
	Male	3	37.5
Age	21–25 years	8	100
Educational level	Third year	1	12.5
	Fourth year	7	87.5
Level of interest in technology	High	8	62.5
	Moderate	1	12.5
	Low	2	25

In this study, a semi-structured interview form developed by the researchers was used as the primary data-collection instrument. The interview questions were designed to explore participants' attitudes toward artificial intelligence (AI), their experiences with AI technologies, the challenges they encountered, and their perspectives on integrating AI into educational content.

The development process began with a comprehensive review of the relevant literature to generate an initial item pool. Subsequently, the draft interview form was evaluated by two experts in special education and one expert in educational technology for clarity, content coverage, alignment with the research questions, and linguistic appropriateness. Based on expert feedback, three items were reworded to reduce ambiguity, two conceptually overlapping items were merged, and minor terminological refinements were made to ensure conceptual consistency in the use of AI-related constructs. These revisions enhanced the content validity and internal coherence of the instrument in accordance with established qualitative research standards (Kallio et al., 2016).

2.2. Measures

For the study, ethical approval was first obtained from the Social and Human Sciences Research Ethics Committee of XXX University (Decision No. 367768, dated 18 August 2025). Prior to the interviews, participants were informed in detail about the purpose of the research, the voluntary nature of their participation, their right to withdraw at any stage without penalty, and the procedures related to audio recording and data use. Written informed consent was obtained from all participants before the commencement of the interviews, and explicit permission for audio recording was secured in advance.

Subsequently, semi-structured interviews were conducted with teacher candidates who agreed to participate in the study, using the "Semi-Structured Interview Form." Each interview lasted approximately 30 minutes. In line with the prior consent obtained, the interviews were audio-recorded to ensure data accuracy and completeness. After all interviews were completed, the researchers initiated the transcription process. For this purpose, an artificial intelligence-assisted audio and video transcription tool (Turboscribe.ai) was used to enable efficient, accurate transcription. To enhance methodological rigor, the researchers carefully reviewed and cross-checked all AI-generated transcripts against the original audio recordings. Through this procedure, the full content of each interview was transcribed accurately while minimizing potential information loss.

2.3. Data Analysis

The research data were analyzed using content analysis. Content analysis is a systematic technique that organizes textual data into meaningful categories through coding procedures conducted within predefined analytical frameworks (Büyüköztürk et al., 2018). In the present study, all participant responses were first transcribed and examined in detail. Subsequently, two researchers independently coded the data and generated preliminary categories and themes through iterative comparison. To ensure the reliability of the coding process, inter-coder reliability was calculated using the formula proposed by Miles and Huberman (1994). The calculated reliability coefficient was 86%, indicating a substantial level of agreement between the coders. Following this calculation, discrepancies were reviewed and resolved through discussion, and the final thematic framework was established based on consensus.

3. Findings

In this section, the findings and interpretations obtained from the analysis of the data collected through semi-structured interviews with special education teacher candidates are presented. The findings are organized into 10 main themes and 25 subthemes associated with them.

3.1. General Perceptions of AI

The majority of participants consider AI technologies functional and practical. P1 evaluated AI as an educationally efficient tool by stating, "It makes our lives easier and enables us to access information quickly and accurately." However, P3 described the rapid development of AI as "frightening," and was among the participants who adopted a cautious approach toward technology. This finding suggests that, although participants' perceptions of technology are generally positive, they harbor concerns about its uncontrolled use. Table 2 presents the categories related to participants' general perceptions of AI.

Table 2 *General Perceptions of AI*

Theme	Subtheme	f	Participants
General perceptions of artificial intelligence	Functionality and practicality	5	P1, P2, P4, P5, P6
	Concern and fear	2	P3, P7
	Overall positive evaluation	1	P8

3.2. Experiences with AI Education

The majority of the participants stated that they had not taken a course specifically focused on AI during their university education. However, P2 reported experiencing individual development through technology-integrated activities embedded in the courses. P6, on the other hand, emphasized that AI was addressed only indirectly in the curriculum. This finding indicates that AI education has not yet been systematically incorporated into teacher education programs. Table 3 presents the categories related to participants' perceptions of their AI education experiences.

Table 3 *Perceptions Regarding AI Education Experiences*

Theme	Subtheme	f	Participants
AI education experience	Lack of formal training	6	P1, P2, P3, P4, P5, P8
	Limited or indirect exposure to training	2	P6, P7

3.3. Benefits of AI in Special Education

Participants placed particular emphasis on AI's capacity to provide individualized instruction in special education. P2 highlighted the transformative role of AI in special education by stating, "Preparing plans tailored to each student can be accomplished in a shorter time and in a more effective manner." In addition, P4 stated that AI could support students with speech and language difficulties by providing feedback aimed specifically at improving their speech and language skills. Table 4 presents the categories related to participants' perceptions of AI's benefits in special education.

Table 4 *Benefits of AI in Special Education*

Theme	Subtheme	f	Participants
Benefits of AI in special education	Individualized educational support	6	P2, P3, P5, P6, P7, P8
	Support in language and communication	2	P4, P6

3.4. Impact of AI Applications

The majority of participants stated that the most prominent impact of AI in education emerges in the areas of material and content development. Participants reported that AI diversifies instructional materials, saves teachers time during adaptation processes, and enables content to be tailored to students' individual characteristics. For example, P4 indicated that AI could help set more accurate

goals in individualized education plans by identifying details that teachers might otherwise overlook. In addition, two participants noted that AI could play important roles in promoting educational equity and supporting individual adaptation. Participants emphasized that AI could equalize learning opportunities by facilitating access to the same materials for students with differing resources. However, some participants viewed AI's contribution to classroom instruction as limited. According to these participants, AI does not play a directly transformative role in current special education practices but instead functions as a supportive tool for teachers. Table 5 presents the categories related to participants' perceptions of the impact of AI applications.

Table 5 ***Impact of AI Applications***

Theme	Subtheme	f	Participants
Impact of AI applications	Material and content development	4	P1, P4, P5, P6
	Equity of opportunity and individual adaptation	2	P3, P8
	Skepticism or limited perspectives	2	P2, P7

3.5. Experience with AI-Supported Content Development

Most participants reported making limited use of AI tools during the content development process. Participant P3 stated, "I prepared presentations using the Gamma website," emphasizing AI's time-saving role in material development. Similarly, P2 reported actively using AI when preparing instructional materials. However, some participants, such as P7, reported that they lacked direct experience with AI tools but had observed their peers' projects. Table 6 presents the categories related to participants' experiences with AI-supported content development.

Table 6 ***AI-Supported Content Development Experience***

Theme	Subtheme	f	Participants
AI-supported content development experience	Personal development and experience	6	P2, P3, P4, P5, P6, P8
	Participants lacking direct experience	2	P1, P7

3.6. Difficulties in the Use of AI

Participants reported various difficulties with the accuracy of information obtained through AI tools, access issues, the need for training, and a lack of technical knowledge. Participant P2 expressed concerns about content reliability, noting that "The possibility that AI may provide incorrect information is the biggest problem." Participant P6 noted that the Turkish equivalents of special education terminology were neither adequately recognized nor used accurately by the system. Table 7 presents the difficulties participants experienced when using AI.

Table 7 *Difficulties in the Use of AI*

Theme	Subtheme	f	Participants
Difficulties in the use of AI	Issues of trust and information accuracy	4	P2, P6, P7, P8
	Access and economic constraints	3	P1, P4, P8
	Need for training and lack of technical knowledge	3	P3, P5, P6

3.7. Ethical Concerns

Most participants reported ethical concerns related to data privacy and shared responsibility. Participant P1 emphasized the risks related to data security, noting that "AI's easy access to photographs and information may lead to ethical issues." Participant P2 pointed out that they had not received AI-related coursework and therefore emphasized the need for teachers to receive training in this area. Participant P8 raised the possibility that some teachers might use AI to avoid professional responsibility. These findings indicate that pre-service teachers need support not only in technical competencies but also in ethical awareness. Table 8 outlines participants' ethical concerns regarding AI.

Table 8 *Ethical Concerns Regarding AI*

Theme	Subtheme	f	Participants
Ethical concerns regarding AI	Data privacy and boundary issues	6	P1, P2, P5, P6, P7
	Insufficient training and avoidance of responsibility	2	P2, P8
	No ethical concerns	1	P4

3.8. The Impact of AI on Learning Processes

The majority of participants reported that AI plays a supportive role in learning processes, particularly by enhancing personalization and motivation. Participants indicated that AI facilitates learning and enhances retention by generating content tailored to students' different learning paces, attention spans, and individual characteristics. For example, Participant P6 noted that AI-based systems provide content adaptable to students' individual needs, which in turn increases students' classroom engagement. Similarly, Participant P5 emphasized that AI offers multidimensional learning opportunities and makes learning more enduring through audiovisual supports. In contrast, two participants perceived the impact of AI on learning processes as limited. Participant P2 stated that behavior management is a fundamental goal in special education and indicated that AI remains insufficient in this regard. This indicates an overall positive perception of AI in learning processes; however, different expectations and limitations may emerge depending on the application area. Table 9 summarizes information regarding the impact of AI on learning processes.

Table 9 *The Impact of AI on Learning Processes*

Theme	Subtheme	f	Participants
The impact of AI on learning processes	Personalization and motivation	6	P1, P3, P4, P5, P6, P8
	Perceived limited benefit	2	P2, P7

3.9. Predictions Regarding AI

Participants believe that AI will assume an increasingly central role in education. Participant P1 supported this view by stating, "The new generation of teachers is closely integrated with AI; therefore, AI will play a key role in shaping future educational practices." However, participants such as P6 emphasized that AI cannot replace teachers and that human interaction is indispensable, particularly in special education. In this context, participants expressed optimism about AI while also underscoring the importance of teacher guidance. Table 10 presents the participants' predictions regarding AI.

Table 10 *Predictions Regarding AI*

Theme	Subtheme	f	Participants
Predictions	A positive and supportive role	5	P1, P4, P5, P6, P8
	The necessity of preserving human interaction	2	P3, P6
	The need for system improvement	1	P2

3.10. Initial Encounter with AI

Most participants reported first encountering AI through social media, peer networks, and mobile applications. Participant P6 stated, "I first learned about AI through social media posts and my friends." This indicates that the process was developed informally. Participant P2 emphasized that AI should not be limited to contemporary tools such as ChatGPT and noted that earlier applications, such as Siri, should also be considered within this scope. Table 11 presents information regarding the participants' initial encounters with AI.

Table 11 *Initial Encounter with AI*

Theme	Subtheme	f	Participants
Initial encounter with AI	Social media and friends	6	P3, P4, P5, P6, P7, P8
	Everyday technological tools	2	P1, P2

4. Discussion and Conclusion

The findings of this qualitative study reveal a critical tension in the current landscape of special education teacher preparation: pre-service teachers possess a high level of awareness regarding the functional potential of AI, yet they operate within a vacuum of formal pedagogical training and ethical

guidance. These results align with and significantly extend the recent body of literature concerning AI in inclusive education settings.

A primary finding of this study is that while participants view AI as a practical, time-saving tool, they lack the technical skills to integrate it effectively. This corroborates the findings of Azizoglu and Çakir (2025), who identified a discrepancy where special education teachers exhibited high attitudes toward ICT but moderate-to-low competency in generative AI due to insufficient training. Similarly, Hocaoğlu (2025) found that while teachers had high theoretical awareness, their ability to integrate AI into educational processes was significantly lower. The current study extends this by illustrating that pre-service teachers are attempting to bridge this gap through informal channels like social media, a strategy that carries risks of misinformation. This finding supports Goldman et al.'s (2025) argument that without standalone, explicit technology coursework, teachers are left to a "do-it-yourself" approach that fails to leverage the full potential of evidence-based writing and instruction practices. Beyond "lack of training," the present study extends the debate by showing that first encounters with AI occur primarily through social media, peers, and everyday tools, implying that competence development is shaped by informal networks rather than the curriculum—an equity concern in teacher preparation.

Participants identified the creation of Individualized Education Programs (IEPs) and the diversification of materials as the most significant affordance of AI. This finding strongly validates the work of Rakap (2024), who demonstrated that AI tools can assist novice teachers in developing high-quality IEP goals and identifying tailored interventions. It also confirms the broader proposition that AI can contribute to inclusive learning through personalization and adaptive supports, but that real-world uptake remains constrained by training and readiness conditions (Almarzouq et al., 2025). The findings are also theoretically consistent with technology acceptance perspectives: in contexts where AI is perceived as useful and manageable, intentions to use strengthen; conversely, when competence and confidence are limited, adoption is inhibited (Yao & Wang, 2024). Notably, participants' emphasis on personalization suggests that "AI literacy" in special education should not be reduced to tool operation; it must include the capacity to align AI outputs with individualized education planning, accommodations, and evidence-based instructional decision-making.

Furthermore, the participants' view of AI as a mechanism for "opportunity equality" aligns with Hopcan et al.'s (2023) systematic review, which highlighted AI's role in personalizing learning environments to meet unique needs. However, the current study adds a nuance regarding the "human element"; participants emphasized that while AI can generate content, it lacks the pedagogical nuance to replace the teacher. This mirrors the metaphorical analysis by Eriçok et al. (2024), where teacher candidates described AI as a "helper" or "assistant" rather than a replacement, emphasizing its role in reducing workload rather than usurping professional judgment. Similarly, this finding aligns with prior conclusions that technology is perceived as support for face-to-face interactions rather than a substitute for authentic encounters (Vellonen et al., 2025). Taken together, these findings position teacher education reform within a broader, human-centred framing: effective AI integration requires safeguarding relational pedagogy and ensuring that assistive and adaptive benefits do not erode professional judgment or care.

Despite the perceived utility, participants expressed profound anxiety regarding data privacy, "hallucinations," and the ethical implications of AI use. These concerns are consistent with Almarzouq et al. (2025), who identified lack of data privacy regulations and clear ethical guidelines as major obstacles to AI adoption in Kuwaiti special education contexts. The participants' specific fear of "responsibility escape"—where teachers might over-rely on AI—resonates with the findings of

Agmaz and Erguleç (2024), whose participants used metaphors like "a huge void" to describe the ethical uncertainty surrounding AI. This suggests that the "digital literacy" defined by Yao and Wang (2024) must be expanded in teacher education to include "AI ethical literacy" to ensure that teachers can navigate the moral complexities of automated decision-making affecting vulnerable populations. The present study extends the debate by explicitly linking ethics to teacher agency and professional accountability—an especially high-stakes dimension in special education, where student data are sensitive and instructional decisions carry significant implications for learners' rights and participation.

While the current study focused on pre-service teachers' opinions, the barriers they anticipated regarding access align with findings from practicing teachers. Çay et al. (2020) noted that even when teachers are willing, infrastructure deficiencies (e.g., lack of internet access and hardware) prevent integration. Similarly, Yaşar and Vuran (2025) found that special education teachers struggle to access paid versions of AI tools (such as Canva Pro or advanced ChatGPT), which limits the practical application of these technologies in under-resourced schools.

This study contributes qualitative evidence that pre-service special education teachers' AI orientations are characterized by pragmatic optimism (particularly regarding personalization and material adaptation) alongside substantive concerns about training deficits, reliability, access inequities, and ethics. The findings underscore that AI integration in special education teacher education is currently shaped more by informal exposure than by systematic curricular design, leaving preparedness uneven and potentially reproducing a new layer of digital inequity within the profession.

4.1. Limitations and Recommendations for Future Research

Several limitations should be considered when interpreting the findings of this study. First, the study relied on a small sample size of eight pre-service special education teachers selected via convenience sampling. While this number is consistent with the phenomenological design aimed at gathering deep, qualitative insights, it restricts the generalizability of the findings to the broader population of special education teachers. Unlike quantitative studies that utilize larger samples to establish broad trends, this study reflects the experiences of a particular cohort within a single institutional context; thus, the results may not be representative of pre-service teachers in different geographical regions or educational programs. Second, the data collected relied exclusively on self-reported perceptions and opinions regarding AI. Self-reported data can be subject to social desirability bias, where participants may overstate their competencies or align their responses with perceived positive expectations of AI integration. Third, the study focused on pre-service teachers who are not yet fully immersed in the professional teaching environment. Their views on the utility of AI for tasks such as Individualized Education Program (IEP) development are based on theoretical knowledge or limited internship experiences rather than long-term professional practice. Finally, this study represents a cross-sectional snapshot of opinions at a time when generative AI technologies are evolving rapidly. The perceptions of technology in education can shift significantly over relatively short periods due to external factors (e.g., the COVID-19 pandemic) or technological advancements. The specific tools mentioned by participants (e.g., ChatGPT, Gamma) and the ethical concerns raised may evolve as new regulations and more specialized AI tools for special education are developed. Future research should consider longitudinal designs to track how these initial perceptions evolve as pre-service teachers transition into the workforce.

5. Declarations

5.1. Author Contributions (CRediT)

The author(s) confirm(s) contribution to the paper as follows: Study conception and design: MS, YİB; data collection: YİB, MS; analysis and interpretation of results: EÖ, YİB, MS; draft manuscript preparation: EÖ, MS. The author(s) reviewed the results and approved the final version of the article.

5.2. Conflict of Interest

The authors declare that there is no conflict of interest to disclose

5.3. Funding Statement

The authors declare that the study received no funding.

5.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request.

5.5. Ethics Approval

This study was approved by the Kırıkkale University Social and Human Sciences Research Ethics Committee (date: 18.08.2025, decision number: 08). All procedures were conducted in accordance with the ethical standards of the relevant institutional ethics committee and the principles of the Declaration of Helsinki. Participation was voluntary, and informed consent was obtained from all participants prior to data collection.

5.6. Use of Artificial Intelligence (AI) Tools

The authors declare that no generative AI tools or automated writing assistance tools were used during the preparation of this work

5.7. Acknowledgements

None

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Development of the data literacy scale in social sciences: A validity and reliability study

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ABSTRACT

The present study will provide important information for future educational strategies and intervention programs by revealing the current status of undergraduate students in data literacy. The current research is a scale development study. The study group consisted of undergraduate students from 20 universities in Türkiye. Data validity and construct analysis were performed using exploratory and confirmatory factor analyses. Whereas the Kaiser–Meyer–Olkin (KMO) value of 0.967 indicated that the sample was perfect, Bartlett's test confirmed that the correlations between the items were adequate. Cronbach's alpha value of 0.973 indicated a very high internal consistency. Furthermore, high reliability was provided with the inter-form correlation of 0.853, the Spearman-Brown coefficient of 0.920, and the Guttman split-half coefficient of 0.919. The exploratory factor analysis revealed that the scale consisted of three sub-dimensions and explained 64.056% of the total variance. The items showed factor loadings above 0.40. The CFA results confirmed that the model represented the three sub-dimensions of data literacy well, and the RMSEA, CFI, IFI, and RFI fit indices were high. Compared with the available scales in the literature, this study makes a significant contribution by presenting a customized, comprehensive measurement tool in the context of the social sciences.

KEYWORDS: Education; Data literacy; Social sciences; Undergraduate students; Technology

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1. Introduction

CERN's mission is explained in the following way: "At CERN, our work helps to uncover what the universe is made of and how it works" (The CERN Council, 2024a). At CERN, experiments are designed to produce large particles, such as the Higgs boson or the top quark, using the Large Hadron Collider (The CERN Council, 2024b). Scientists design and conduct studies to learn what was happening in the universe, even before they existed, to increase understanding of matter and the universe's origins by measuring its properties. To this end, they plan extensive research with many participants, spend large sums of money, and continue it for years. The main purpose is to reach the "first data," the "notion" regarding how the universe or world is formed. It can be stated that data existed before humanity and gradually grew to gigantic proportions. When the increasing impact of digitalization is added to the growing amount of data every second, huge volumes of data are generated.

A significant increase in worldwide data volume and the rapid development of data-processing technologies have attracted attention. This has caused a greater need to conduct studies addressing and examining data and, therefore, categorizing, analyzing, combining, making meaningful, and using

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data. In this respect, it is critical to examine data, the first step in reaching the data, information, knowledge, and wisdom (DIKW) scheme (Ackoff, 1989), and data literacy, which refers to reading data. To this end, it is necessary to first define the data and then determine its characteristics and boundaries.

1.1. Literature Review

The dictionary definitions of data are as follows: (1) Factual information used as a basis for reasoning, discussion, or calculation; (2) digital information that can be transmitted or processed digitally; (3) something provided by a device or organ that includes useful, irrelevant, or redundant information and must be processed to be meaningful (Merriam-Webster, 2024).

The literature states that data consist of symbols, simple, unrefined, and usually unfiltered things that include the characteristics of objects and events (Amidon, 1997; Ackoff, 1989; Davenport & Prusak, 2000; Kelley, 2002; Liew, 2007). Data represent the characteristics of not only objects or events but also living beings, ideas, emotions, times, places, and many other phenomena in the world. Data are nothing unless they concern you; once they begin to concern you, data may be everything (Gencer & Altun, 2021). In general terms, as stated by Demirtaş (2022), data can be expressed as simple, unrefined numbers, symbols, words, records of events, calculations, images, observations, numerical or verbal expressions, etc., obtained by individuals through experiments, observations, or by chance.

As the data definitions indicate, they have many forms and characteristics. In this data universe, it has become necessary for individuals to know which data, where, how, and by what means they will obtain it, and under what principles they will use it in their daily or business lives. This requires individuals to be able to read data. Literacy, specifically data literacy, comes to the forefront at this stage. In an interdisciplinary context, literacy can be defined as the ability to define, understand, interpret, create, calculate, and communicate using visual, auditory, and digital materials (Demirtaş, 2022). In addition to knowing, literacy involves displaying developed/advanced/high-level skills and/or abilities in that direction, and developing behaviors toward awareness (İnan, 2021).

Regarding data literacy, Schield (2004) described it as a set of skills, including accessing, evaluating, manipulating, summarizing, and presenting data. As defined by Qin and D'Ignazio (2010), data literacy is the ability to understand, use, and manage data. According to another definition, data literacy is "a person's level of understanding of how to find, evaluate, and use data to know how to teach" (Mandinach & Gummer, 2016). By contrast, data literacy involves formulating hypotheses, identifying problems, interpreting data, and planning, thereby enabling data to be converted into information and, ultimately, into actionable knowledge. According to Calzada Prado and Marzal (2013), data literacy enables individuals to access, interpret, critically evaluate, manage, process, and use data ethically. Another aspect of data literacy involves understanding what data mean, including critically evaluating data, knowing how to read graphs and tables appropriately, drawing correct conclusions from data, and recognizing when data are used in misleading or inappropriate ways (Carlson et al., 2011; Koltay, 2015). In general terms, data literacy can be expressed as a set of skills, including obtaining data (from whom, by what means, and under what conditions data are collected); evaluating, interpreting, and using data; and carrying out this process within the framework of ethical principles.

Definitions of data literacy also reveal a framework for data literacy. This framework or indicator reveals the dimensions considered important for a data-literate individual to acquire. Although the content of these dimensions may differ slightly depending on the relevant subject or field, different

researchers have revealed similar structures. Considering this structure, D'Ignazio and Bhargava (2015) categorized data literacy as follows: reading data; working with data; analyzing data; arguing with data. Calzada Prado and Marzal (2013) indicated the following five dimensions of data literacy: understanding data; finding and/or obtaining data; reading, interpreting, and evaluating data; managing data; using data. Deahl (2014) expressed six dimensions of data literacy: understanding data, finding data, collecting data, interpreting data, visualizing data, and supporting arguments using data.

Based on the literature, a simple and comprehensive structure for data literacy can be presented, including the following dimensions: defining data; detecting/accessing data; collecting data; organizing data; using data; and the ethical dimension of data.

The rapidly changing technological and scientific environment requires individuals to understand, interpret, and use the data effectively. In this regard, the education system will inevitably play a role in ensuring that students acquire data literacy skills. Measuring data literacy skills is as important as ensuring that students acquire them. This reveals the need for an appropriate measurement tool to determine the current status of data literacy skills.

Advancements in science and technology have transformed the concepts of assessment and evaluation in parallel with changes in our century's understanding of the learning-teaching process. In addition to these activities carried out with a student-centered education approach, assessment and evaluation practices have also evolved to allow students and their peers to evaluate their own work. Thus, students can actively participate in the evaluation process and perceive themselves and their environment from a personal perspective. This creates an environment in which they can analyze their strengths and weaknesses and succeed in life (Çalışkan, 2012).

Upon examining the literature, two scales have been developed to assess the data literacy status of associate degree students and teachers. Kim et al. (2023) conducted a study to explore how college students in the United States of America evaluate their data literacy and to examine demographic and education/career progression differences in self-evaluated data literacy levels among 573 students at four community colleges. The researchers developed a three-factor, 24-item "data literacy scale" with reliability and construct validity. Trantham et al. (2021) developed the "NU Data Knowledge Scale (NUDKS)" to reliably evaluate educators' data-usage skills and determine teachers' data literacy for in-class data use. The scale development process was tested for its suitability for the Rasch model.

When the existing scales in the literature are examined, they primarily aim to measure individuals' self-perceived data literacy levels within specific contexts, such as community college students or in-service teachers' classroom data use. For instance, the scale developed by Kim et al. (2023) focuses on university students' self-evaluations of their data literacy skills, whereas the NU Data Knowledge Scale (Trantham et al., 2021) assesses educators' competencies in using data for instructional purposes. These instruments provide valuable contributions by operationalizing data literacy within their respective target groups and professional contexts. However, a scale specifically designed to conceptualize and measure data literacy within the social sciences at the undergraduate level appears to be scarce in the literature. Therefore, the present study aims to address this gap by developing a data literacy scale grounded in the theoretical dimensions of data literacy and tailored to the epistemological and methodological characteristics of social sciences.

1.2. Purpose

The present study aims not only to develop a valid and reliable data literacy scale but also to establish a theoretically grounded and empirically validated multidimensional framework of data literacy

within the context of social sciences. By modeling data literacy as a higher-order construct, the study seeks to contribute to conceptual clarification in the field and to provide a psychometrically robust instrument for future research, curriculum development, and educational policy implementation.

2. Method

2.1. Study Group

The study group consisted of students enrolled in the 1st, 2nd, 3rd, and 4th grades at 20 universities in Türkiye. A purposive sampling method was employed, and within this framework, criterion sampling was adopted. The inclusion criterion was defined as being an actively enrolled undergraduate student at the time of data collection.

Cohen and Cohen (1983) stated that a minimum of ten participants should be included in each variable. As a general rule, it was suggested that the minimum sample size should be at least five times the number of variables to be analyzed, and that a more acceptable ratio is 10:1 (Hair et al., 2014). In the present study, 381 individuals were included, which is more than 11 times the number of variables for exploratory factor analysis (EFA). It is usually stated that sample sizes of at least 200, 250, or 500 people, or 3, 6, or 20 times the number of variables, should be used for confirmatory factor analysis (CFA) (De Winter et al., 2009; Uyumaz & Sırgancı, 2020). In this study, 200 individuals, approximately six times the number of variables, were included. Table 1 lists participants' information.

Table 1 ***EFA-CFA Participant Information***

Group	Male	Female	1st Grade	2nd Grade	3rd Grade	4th Grade
EFA (N=381)	106	275	83	90	78	130
CFA (N=200)	49	151	18	65	37	80

2.2. Data Collection and Analysis

Clark and Watson (1995) stated that scale development is a process that includes a clear definition of the target structure, carefully creating an item pool, testing the items in the pool on a representative sample, and assessing dimensionality and discriminant validity with inter-item correlation and factor analysis (as cited in Koyuncu & Kılıç, 2019). In this study, the process was carried out with these stages in mind.

In this research, content and construct validity were examined as part of the validity studies. To ensure content validity, a literature review was conducted, as specified above, and statements on the scale were presented to experts. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to examine construct validity.

In exploratory factor analysis (EFA), researchers aim to determine the most appropriate number of factors, reveal whether the measured variables (items) are reasonable indicators of latent dimensions, and elucidate the theoretical structure (Goodwin, 1999; Brown, 2015). Confirmatory factor analysis (CFA) tests the fit of a hypothetical factor structure to the observed covariance structure of the measured variables and provides empirical support for theoretical assumptions (Goodwin, 1999; Jöreskog, 1971; Floyd & Widaman, 1995; Koyuncu & Kılıç, 2019; Uyumaz & Sırgancı, 2020). Prior to factor analysis, the suitability of the data obtained from undergraduate students for factor analysis was examined using the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's test of sphericity.

Corrected item-total correlation coefficients, Cronbach's alpha internal consistency coefficients, and Guttman split-half coefficients were calculated within the scope of reliability studies.

2.3. Ethical Considerations

This study was conducted in accordance with established ethical principles. Prior to data collection, ethical approval was obtained from the Adıyaman University Social and Humanities Ethics Committee (decision dated 14.05.2024 and numbered 53). The approved research protocol was reviewed and authorized by the committee. As the data were collected from undergraduate students, the official ethics committee approval was secured before the study commenced, and the approval document was presented to the participants during the research process.

3. Findings

3.1. Scale Development Steps

When developing the scale form, the literature on data, literacy, and data literacy was first reviewed, and the theoretical framework for data literacy and its dimensions was created. The dimensions were used to avoid overlooking any points when writing the items.

Within the scope of the dimensions identified in the literature, a pool of 45 items to measure undergraduate students' data literacy perceptions was created. To evaluate the items in the pool for content validity, they were presented to 10 academicians and experts in data literacy, and experts' feedback was received using the Lawshe form. In line with the experts' opinions, 11 items were removed from the scale form, leaving 34 items. Table 3 presents the findings on the items, including content validity ratios and indices specified in the literature, as evaluated by domain experts using the Lawshe technique (Lawshe, 1975). Within the scope of the experts' suggestions for other items, the scale items were corrected for language consistency, in line with the assessment and evaluation criteria. Two language expert academicians were consulted to evaluate the clarity and comprehensibility of the items in terms of meaning. The items were corrected within the scope of the suggestions provided by domain experts.

The scale was pre-applied to 20 undergraduate students who were not included in the intervention. Necessary corrections were made to the scale form, which was finalized in line with the undergraduate students' suggestions and expert evaluations. The final version of the scale included 34 items. Each item in the scale form was rated on a Likert-type scale ranging from (5) strongly agree, (4) agree, (3) no idea, and (2) disagree to (1) strongly disagree. The scale was applied to undergraduate students studying at 20 universities in Türkiye. Table 1 lists the students' demographic information. Data obtained from the intervention were analyzed.

3.2. Findings Regarding Content Validity

Table 2 presents the minimum content validity criteria (CVC) that items should meet, based on the total number of experts who expressed their opinions, as specified by Veneziano and Hooper (1997).

Table 2 ***Content Validity Criteria (Veneziano & Hooper, 1997)***

Number of Experts	Minimum Value
5	0.99
6	0.99
7	0.99

Number of Experts	Minimum Value
8	0.78
9	0.75
10 (present study)	0.62

Opinions in the expert evaluation form were analyzed and interpreted using Lawshe's technique. After obtaining expert opinions through the expert evaluation form, content validity ratios (CVRs) for the items were obtained, and the scale's content validity index (CVI) was calculated. Ultimately, the final form was created based on the items' CVRs, and the scale's CVI was calculated from the items' CVRs.

Table 3 ***Content Validity Rates***

Items	N Experts	Essential	Not Necessary	CVR
Item 1	10	9	1	0.8
Item 2	10	9	1	0.8
Item 3	10	9	1	0.8
Item 4	10	10	0	1
Item 5	10	9	1	0.8
Item 6	10	9	1	0.8
Item 7	10	9	1	0.8
Item 8	10	9	1	0.8
Item 9	10	10	0	1
Item 10	10	10	0	1
Item 11	10	9	1	0.8
Item 12	10	10	0	1
Item 13	10	9	1	0.8
Item 14	10	10	0	1
Item 15	10	10	0	1
Item 16	10	9	1	0.8
Item 17	10	10	0	1
Item 18	10	9	1	0.8
Item 19	10	10	0	1

Items	N Experts	Essential	Not Necessary	CVR
Item 20	10	10	0	1
Item 21	10	9	1	0.8
Item 22	10	9	1	0.8
Item 23	10	10	0	1
Item 24	10	9	1	0.8
Item 25	10	9	1	0.8
Item 26	10	10	0	1
Item 27	10	10	0	1
Item 28	10	10	0	1
Item 29	10	9	1	0.8
Item 30	10	10	0	1
Item 31	10	10	0	1
Item 32	10	10	0	1
Item 33	10	10	0	1
Item 34	10	10	0	1
				CVR = 31.4 | CVI = 0.92

As shown in Table 3, the CVR values for the items in the draft form ranged from 0.8 to 1.00. The CVR was calculated to be 31.4. The content validity index (CVI) was obtained from the total CVR averages of the items significant at $\alpha = 0.05$, and included in the final form. The CVI value of 0.92 indicates that the scale is statistically significant (Lawshe, 1975).

3.3. Findings Regarding Validity Studies

3.3.1. Exploratory Factor Analysis

Exploratory factor analysis (EFA) was performed to determine the construct validity of the Data Literacy Scale (DLS) and to reveal the factor structure. The Kaiser-Meyer-Olkin (KMO) sample adequacy value was 0.967, indicating that the sample size was adequate for EFA (Field, 2009; Nikkhah et al., 2018). The lowest KMO value calculated for each item was 0.941, confirming that the sample size was adequate. Additionally, Bartlett's test found $\chi^2(561) = 11048.951$; $p < .05$, and this finding demonstrated that the inter-item correlations were sufficiently large for EFA.

A Cronbach's alpha value of 0.973 indicates very high internal consistency. This shows that the 34 items of the scale are highly consistent with each other and that the scale is a reliable measurement tool. In social sciences, Cronbach's alpha value above 0.70 is generally considered acceptable; the value between 0.80–0.89 is considered good; the value of 0.90 and above is considered excellent. In

this respect, a value of 0.973 indicates that the scale has excellent internal consistency and that all items are compatible with the overall structure (DeVellis, 2012; Hair et al., 2014; Sarmento & Costa, 2017).

After the data were deemed suitable for factor analysis, an exploratory factor analysis was conducted to assess the scale's construct validity. Principal components and the direct oblimin method were employed. The principal component method was selected to reduce dimensionality, strengthen interpretation, and prevent information loss. Because these factors are theoretically related, the direct oblimin method was selected. Oblique rotations allow correlated factors rather than maintaining independence among the rotated factors (Hair et al., 2014). Worthington and Whittaker (2006) argued that the minimum factor loadings should be as high as possible; thus, this would reduce cross-loading. Hair et al. (2014) reported that factor loadings in the range of ±.30 and ±.40 meet the minimum level for interpreting the structure. This study determined the minimum factor loading to be 0.40. In the analysis, all the items had values greater than 0.40. Therefore, the analysis continued without deleting any items.

Table 4 ***Total Variance Explained***

Comp.	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %	Rot. Total[a]
1	18.388	54.083	54.083	18.388	54.083	54.083	16.862
2	2.047	6.021	60.104	2.047	6.021	60.104	12.306
3	1.344	3.952	64.056	1.344	3.952	64.056	10.099

Note. Extraction Method: Principal Component Analysis. [a] When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

The EFA determined that the 34-item Data Literacy Scale has three subdimensions (factors). According to the Kaiser criterion, components have eigenvalues higher than 1 (Braeken & Van Assen, 2017). Hence, these three components were considered in the analysis. These three factors account for 64.056% of the total variance. Furthermore, it was revealed that the first sub-dimension explained 54.083% of the variance, the second explained 60.104%, and the third explained 64.056%. Accordingly, we concluded that the "Data Literacy Scale" was valid. The rotation sums yield a more balanced distribution of variance by accounting for correlations among the components.

Table 5 ***Item-Total Statistics***

Item	Scale Mean if Deleted	Scale Var. if Deleted	Corrected Item-Total r	α if Item Deleted
i1	136.74	395.441	.635	.973
i2	136.86	394.969	.604	.973
i3	137.01	395.616	.518	.973
i4	136.87	392.105	.634	.973
i5	136.79	392.833	.641	.973
i6	136.76	392.711	.639	.973

Item	Scale Mean if Deleted	Scale Var. if Deleted	Corrected Item-Total r	α if Item Deleted
i7	136.82	392.866	.658	.973
i8	136.92	391.812	.632	.973
i9	136.88	392.068	.646	.973
i10	136.61	392.291	.759	.972
i11	136.81	391.740	.655	.973
i12	136.60	389.035	.789	.972
i13	136.83	389.005	.708	.972
i14	136.83	388.503	.763	.972
i15	136.79	388.075	.764	.972
i16	136.62	389.352	.792	.972
i17	136.81	388.712	.714	.972
i18	136.94	389.765	.661	.973
i19	136.67	389.765	.782	.972
i20	136.65	388.560	.795	.972
i21	136.70	389.669	.773	.972
i22	136.72	388.414	.790	.972
i23	136.73	389.614	.784	.972
i24	136.96	391.906	.589	.973
i25	136.72	389.164	.789	.972
i26	136.87	389.190	.708	.972
i27	136.68	388.156	.794	.972
i28	136.75	390.022	.744	.972
i29	136.69	389.719	.725	.972
i30	136.62	390.894	.757	.972
i31	136.58	390.013	.755	.972
i32	136.57	390.871	.771	.972

Item	Scale Mean if Deleted	Scale Var. if Deleted	Corrected Item-Total r	α if Item Deleted
i33	136.71	388.892	.698	.973
i34	136.61	388.643	.757	.972

Evaluation of Item-Total Statistics: Corrected Item-Total Correlation — the correlation values for all the items varied between 0.518 and 0.795. This indicates that all items are in good agreement with the scale's overall structure and support its reliability. Cronbach's alpha if an item was deleted remained between 0.972 and 0.973 when any item was deleted, indicating that deleting any item from the scale does not significantly impact the overall reliability.

Three factors emerge, given that Hair et al. (2014) stated that factors with eigenvalues greater than 1 should be taken into account (Scree Plot Analysis). Hence, the analysis considers the first three components.

Table 6 ***Items' Distribution by Factors and Factor Loadings***

Item	Factor 1 Data Collection	Factor 2 Data Processing	Factor 3 Ethics
i1	.708		
i2	.754		
i3	.696		
i4	.752		
i5	.732		
i6	.658		
i7	.712		
i8	.597		
i9	.487		
i10		.555	
i11		.652	
i12		.576	
i13		.586	
i14		.462	
i15		.493	
i16		.719	
i17		.652	

Item	Factor 1 Data Collection	Factor 2 Data Processing	Factor 3 Ethics
i18		.653	
i19		.758	
i20		.758	
i21		.731	
i22		.910	
i23		.858	
i24		.667	
i25		.827	
i26		.615	
i27		.788	
i28		.810	
i29			.656
i30			.680
i31			.660
i32			.727
i33			.702
i34			.653

Note. The 'minimum residual' extraction method was used in combination with an 'oblimin' rotation. Factor loading values below 0.40 are not given in the table.

As seen in Table 6, the first sub-dimension comprised nine items (items 1–9), the second comprised 19 items (items 10–28), and the third comprised six items (items 29–34). The lowest factor loading is 0.462. Therefore, since factor loadings of 0.40 or higher are considered ideal (Field, 2009), the items were considered to contribute significantly to the factors. Furthermore, the factors were named as "Data Collection," "Data Processing," and "Ethics" respectively.

Table 7 ***Factor Names and Reliability***

No.	Factor Name	No. of Items	Cronbach's α
1	**Data Collection**	9	0.902
2	**Data Processing**	19	0.964
3	**Ethics**	6	0.940

No.	Factor Name	No. of Items	Cronbach's α
Total		34	**0.973**

Table 7 shows the number of items and Cronbach's alpha reliability coefficients for the Data Collection, Data Processing, and Ethics factors. High Cronbach's alpha values indicated that the scale had high internal consistency and reliability.

Table 8 ***Component Correlation Matrix***

Component	1	2	3
1	1.000	0.651	0.573
2	0.651	1.000	0.383
3	0.573	0.383	1.000

The component correlation matrix shows that Component 1 and Component 2 had a moderate positive correlation (r = 0.651), indicating that these two factors overlapped to some extent. Component 1 and Component 3 showed a moderate positive correlation (r = 0.573). Components 2 and 3 showed a lower but positive correlation (r = 0.383).

3.3.2. Reliability Statistics

Table 9 ***Reliability Statistics***

Measure	Part 1	Part 2	Total	Corr. Between Forms	Spearman-Brown (Equal)	Spearman-Brown (Unequal)	Guttman Split-Half
α Value	0.945	0.961	0.853	0.853	0.920	0.920	0.919
No. Items	17	17	34				

Cronbach's alpha values higher than 0.9 in both parts (Part 1: 0.945; Part 2: 0.961) indicate that the scale had high internal consistency. A high correlation between the forms (r = 0.853) indicates that the two parts are quite similar and that the scale has a consistent structure. The high Spearman-Brown coefficient (0.920) for both equal and unequal lengths supports the scale's reliability and consistency. The high Guttman split-half coefficient (0.919) indicates that the scale is highly reliable, even when split in half.

3.3.3. Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) was performed to confirm the factor structure. Whereas EFA investigates the factor structure of how variables are related within a group, the results of the CFA conducted using LISREL confirm the factor structure extracted from EFA.

Table 10 ***Pre- and Post-Modification CFA Fit Indices***

Fit Index	Pre-Modification	Post-Modification	Criteria
χ^2/df	2.49 (1306.47/524)	2.25 (1170.49/520)	≤ 2.5 = perfect fit
RMSEA	0.086	0.077	≤ 0.05 = perfect fit; ≤ 0.06 = good fit

Fit Index	Pre-Modification	Post-Modification	Criteria
CFI	0.97	0.97	≥ 0.90 = good fit
RMR	0.037	0.035	≤ 0.05 = perfect fit
IFI	0.97	0.97	≥ 0.90 = acceptable fit
TLI	0.94	0.97	≥ 0.90 = acceptable fit
RFI	0.94	0.95	≥ 0.90 = acceptable fit
Std. RMR	0.064	0.060	≤ 0.05 = perfect fit

The fit indices presented in Table 10 indicate that the model provided a good-to-perfect fit both before and after modification. The χ^2/df value improved from 2.49 to 2.25, both within the perfect fit criterion of ≤ 2.5. RMSEA improved from 0.086 to 0.077; CFI and IFI remained at 0.97 in both cases, indicating a good fit. RMR improved from 0.037 to 0.035; TLI improved from 0.94 to 0.97; and RFI improved from 0.94 to 0.95. As a result of the first analysis, the modifications suggested by the program for items 6–5, 12–10, 22–21, and 28–27 were implemented by the researcher for the items within the same dimension.

Factor loadings indicate that the main factor "data literacy" relates to its sub-dimensions as follows: Data Collection (λ = 0.80), Data Processing (λ = 1.02), and Ethics (λ = 0.85). These loadings demonstrate that data literacy has three sub-dimensions that are strongly related to the main factor.

4. Discussion

The Kaiser-Meyer-Olkin (KMO) sample adequacy value was 0.967, indicating that the sample size was adequate for EFA. The Kaiser-Meyer-Olkin values between 0.00–0.49 are classified in the "unacceptable" category, values between 0.50–0.70 are classified in the "mediocre" category, values between 0.70–0.80 are classified in the "good" category, values between 0.80–0.90 are classified in the "high" category, and values of 0.90 and above are classified in the "excellent" category (Field, 2009; Nikkhah et al., 2018). The lowest KMO value calculated for each item was 0.941, confirming that the sample was adequate. Furthermore, Bartlett's test found $\chi^2(561) = 11048.951$; $p < .05$, demonstrating that inter-item correlations were adequate for EFA.

Cronbach's alpha was 0.973. This indicates that the 34 items of the scale are highly consistent with each other and that the scale is a reliable measurement tool. In this respect, the value of 0.973 indicates that the scale has excellent internal consistency and that all items are compatible with the overall structure. All values, such as Cronbach's alpha, Spearman-Brown coefficient, and Guttman split-half coefficient, confirmed that the scale provided consistent and reliable results when divided into parts and as a whole. In the social sciences, the reliability score measured by Cronbach's alpha is considered acceptable when the threshold of .70 is exceeded (Hair et al., 2014; DeVellis, 2012), the value between 0.80–0.89 is considered good, and it is considered excellent when it takes the value between 0.90–1.00 (Sarmento & Costa, 2017). These results support that the scale is a valid and reliable measurement tool.

The EFA determined that the 34-item Data Literacy Scale has three subdimensions (factors). Components 1, 2, and 3 had eigenvalues of 18.388, 2.047, and 1.344, respectively, and, according to the Kaiser criterion, factors with eigenvalues greater than 1 were considered significant (Braeken & Van Assen, 2017). These components explained 64.056% of the total variance and represented a

significant portion of the dataset. Additionally, it was found that the first sub-dimension explained 54.083% of the variance, the second 60.104%, and the third 64.056%. Accordingly, we concluded that the "Data Literacy Scale" was valid.

Furthermore, the CFA shows that the model's fit indices represent the three sub-dimensions of data literacy (collection, processing, and ethics). High RMSEA, CFI, IFI, and RFI values indicate that the model provides a very good fit compared with the independent model. A χ^2/df value ≤ 2 indicates a good fit (Cole, 1987, as cited in Karaman, 2023). It is stated that if this coefficient falls between 2 and 5, it is an acceptable level (Hu & Bentler, 1999; Kline, 2016). An RMSEA value between 0.08 and 0.10 is considered a mediocre fit (MacCallum et al., 1996), a value of 0.07 or below is considered an acceptable-reasonable fit (Steiger, 2007), and a value equal to or lower than 0.05 is considered a very good fit (Sarmento & Costa, 2019). Brown (2015) reported that fit indices are divided into three groups: absolute fit indices (χ^2, SRMR, and RMR), parsimony fit indices (RMSEA), and comparative fit indices (CFI-IFI, TLI), and suggested using at least one index from each group in reporting (as cited in Koyuncu & Kılıç, 2019).

Exploratory factor analysis (EFA) revealed that the scale comprises three sub-dimensions, which explain a significant portion of the total variance. All items exceeded the determined minimum factor loading, and high Cronbach's alpha values strongly supported the scale's internal consistency and reliability. The results of the confirmatory factor analysis (CFA) demonstrate that the scale has a high model fit and successfully represents the three sub-dimensions of data literacy. These findings confirm that the data-literacy scale is a valid and reliable measurement tool. In its current form, this model provides a solid foundation for research on data literacy.

The Data Literacy Scale developed in the current study was meticulously evaluated for validity and reliability and demonstrated strong performance. These results reveal important similarities and differences when compared with the scales available in the literature. For instance, Kim et al. (2023) showed that the three-factor, 24-item Data Literacy Scale, developed for university students, demonstrated high reliability and construct validity. Likewise, the "NU Data Knowledge Scale (NUDKS)", developed by Trantham et al. (2021), was designed to reliably evaluate educators' data literacy and data usage skills, and was tested for its suitability to the Rasch model. Although both scales were evaluated as valid and reliable, they differ from this study in terms of purpose, scope, and items. In particular, while studies by Evans and Trantham address data literacy within a general framework, the scale developed in the current study aims to measure data literacy in the context of social sciences.

4.1. Implementing the Scale in Different Cultural Contexts

Examining the scale's validity and reliability across culturally diverse contexts (countries or cultures) will support its international use. Cross-cultural validity tests can reveal whether a scale works similarly in different cultural groups.

4.2. Use for Practical Applications and Training Programs

The results obtained can be used to develop data literacy training programs. This scale can be used to measure the effects of training programs and assess participants' progress.

5. Declarations

5.1. Author Contributions (CRediT)

Çağrı Demirtaş: Conceptualization, Methodology, Investigation, Formal Analysis, Data Curation, Writing – Original Draft, Writing – Review & Editing, Visualization, Project Administration.

5.2. Conflict of Interest

The author declares no financial, commercial, or personal conflicts of interest related to this study.

5.3. Funding Statement

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The study was not supported by any institutional research program, foundation, or ministry.

5.4. Data Availability Statement

The data related to the study can be accessed via the links given below.

EFA:
https://docs.google.com/spreadsheets/d/17r33zkIzZ3xHO7NFZoPRhwO5s00xtzyiWMiZKUhJzNk/edit?usp=sharing

CFA:

https://docs.google.com/spreadsheets/d/13RTYYMR5ihpa7OH_CqJ3NRxaZge-zOjIDgymkkiofaU/edit?usp=sharing

5.5. Ethics Approval

Ethical approval for this study was granted by the Adıyaman University Social and Humanities Ethics Committee (Approval No: 53; Approval Date: 14.05.2024). The purpose of the study is to develop a data literacy scale for use in the social sciences field. Participation was entirely voluntary, and no personally identifiable information was requested from participants. All responses were kept strictly confidential and evaluated solely by the research team. The data obtained will be used exclusively for scientific publications.

5.6. Use of Artificial Intelligence (AI) Tools

The authors disclose the use of AI-assisted tools in the preparation of this manuscript. During the preparation of this study, the authors used ChatGPT for language editing and reference ordering purposes. After using this tool, the authors revised and organized the content and references as needed; the AI tool used has been included in the reference list. AI tools were not used to generate or alter empirical data, produce analytical results, or shape the study's core findings and conclusions. All AI outputs were reviewed and verified by the authors, who take full responsibility for the integrity, originality, and accuracy of the content.

5.7. Acknowledgements

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6. Appendix: Data Literacy Scale Items

Table A1 presents all 34 items of the Data Literacy Scale in Social Sciences, organized by sub-dimension.

Table A1 ***Data Literacy Scale — Items by Sub-Dimension***

Dimension	Items
Data Collection	i1. I know that there are different types of data.
	i2. I know that everything that exists in nature can be data.
	i3. I know that for something to be data, it must be processed.
	i4. I know that verbal expressions can be data.
	i5. I know that data existed before the invention of computers.
	i6. I know that data will not end when computers disappear.
	i7. I know that sounds can be data.
	i8. I know that data exist in nature by itself.
	i9. I know where I can access the data I need.
Data Processing	i10. I know that data can be collected from people.
	i11. I know that data can be collected from animals.
	i12. I know that data should be collected in line with the purpose.
	i13. I know that data can be collected from everything in nature.
	i14. I know how to access the needed data.
	i15. I know that data can be collected without the help of a technological tool.
	i16. I know that data are meaningful when collected in line with a purpose.
	i17. I know that even a pen and paper will be enough as a data collection tool.
	i18. I know that it is not necessary to be an expert to collect data.
	i19. I know that data such as symbols, numbers, images, sounds, etc. can be processed by bringing them together.
	i20. I know that data turn into information when processed.
	i21. I know that data processing increases the usability of that data.

Dimension	Items
	i22. I know that data can be formed from information again.
	i23. I know that data are also used outside of scientific research.
	i24. I know that it is impossible to use all the data that exist in nature nowadays.
	i25. I know that data can be used multiple times.
	i26. I know that everyone uses data in their daily lives.
	i27. I know that the use of data makes it easier to understand a situation.
	i28. I know that data will not lose its function when used.
Ethics	i29. I know that it is necessary to inform participants to collect data.
	i30. I know that the actual purpose should be disclosed when collecting data.
	i31. I know that it is illegal to share the data of the person(s) from whom the data were collected with others without their permission.
	i32. I know that it is necessary to receive permission from individuals to collect data from them.
	i33. I know that the data should not be used for any purpose other than the purpose for which it was collected.
	i34. I know that legal permissions received to collect data must be presented to the participant.

Student-led policy advocacy as living labs: Examining civic capability development in Indonesian higher education

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ABSTRACT

This study examines whether living lab pedagogy develops civic capabilities in Indonesian university students. In a semester-long course, 98 students formed 20 teams executing authentic advocacy campaigns on self-selected policy issues. Using mixed methods (surveys, interviews, and document analysis), we assessed the development of civic capability across six domains. Teams collectively generated 127,000 petition signatures and engaged civil society organizations. Thematic analysis reveals that governance and justice issues dominated priorities (45%), with 65% of campaigns motivated by direct experiences of policy failure. Interview data (n=35) suggest shifts in civic identity and increased political efficacy. However, the study's preliminary nature, lack of comparison group, and limited follow-up constrain causal claims. Findings suggest living labs offer a promising pedagogical model, though longitudinal experimental research is needed.

KEYWORDS: Civic education; experiential learning; political science pedagogy; student activism; living labs

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1. Introduction

Political science educators face a persistent challenge: how to transform civic knowledge into civic action. While students can articulate democratic principles and analyze policy issues, they often lack the practical competencies and self-efficacy necessary for political engagement (Beaumont et al., 2006; Colby et al., 2007). This gap between knowledge and action is particularly pronounced in emerging democracies like Indonesia, where youth constitute 52% of the population yet remain largely absent from governance processes (Badan Pusat Statistik, 2024).

The problem extends beyond individual disengagement. When the lived experiences and perspectives of young citizens are systematically excluded from policymaking, democratic legitimacy suffers and policy effectiveness declines (Cornwall & Gaventa, 2001). From a capability approach perspective (Sen, 1999), this exclusion represents not just a political problem but a development failure—the suppression of fundamental freedoms necessary for human flourishing.

This study investigates whether 'living lab' pedagogy can address this challenge. Living labs, originally developed in innovation studies (Almirall & Wareham, 2011), are real-world experimental environments where users co-create solutions to authentic problems. Bergvall-Kåreborn and Ståhlbröst (2009) define living labs by five characteristics: user involvement (end-users as co-

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creators rather than passive subjects), authentic contexts (real-world settings rather than laboratory conditions), multi-method approaches (combining qualitative and quantitative data), multi-stakeholder participation (involving diverse actors), and co-creation (collaborative innovation processes).

Similarly, Almirall and Wareham (2011) emphasize that living labs function as 'innovation arbiters,' mediating between top-down institutional initiatives and bottom-up user innovations. This intermediary role creates spaces where formal and informal knowledge interact, where expert and experiential knowledge cross-fertilize, and where conventional approaches confront practical challenges requiring adaptive solutions.

Recent scholarship extends living labs beyond technological innovation to social and governance challenges. Evans and Karvonen (2014) analyze urban living labs addressing climate change and sustainability, arguing that these spaces enable experimentation with governance arrangements and policy instruments that would be politically risky to implement at full scale. The living lab provides a 'safe space' for testing innovations while maintaining authentic stakes and consequences.

We adapt this concept to civic pedagogy by framing student-led policy advocacy campaigns as living labs for developing democratic capability. Students become co-creators of actual political interventions rather than passive recipients of civic instruction. Real-world policy contexts provide authentic settings where students encounter genuine stakeholders, face actual political constraints, and experience real consequences—whether success or failure. The pedagogical intervention combines structured support (theoretical frameworks, skills workshops, coaching) with substantial student autonomy over issue selection, strategy development, and tactical decisions.

This approach differs from service-learning in several ways. First, living labs center political advocacy rather than service provision, positioning students as citizens demanding accountability rather than volunteers providing assistance. Second, students select issues affecting their own communities or that concern them, collapsing the helper-helped distinction common in service-learning. Third, living labs explicitly aim to develop political capabilities and identity, not merely to provide community benefit or foster moral development.

Living labs also differ from simulations in that they maintain authentic stakes. When students launch real petitions visible to actual publics, engage actual stakeholders who may accept or refuse collaboration, and pursue policy changes that may or may not occur, they cannot retreat to 'this is just an assignment.' This authenticity fundamentally alters the psychological experience and, we hypothesize, the learning outcomes.

1.1. The Indonesian Context: Youth Exclusion in an Emerging Democracy

Indonesia provides an important context for this study. As the world's third-largest democracy with 275 million citizens (BPS, 2024), Indonesia represents a critical case for understanding democratic development in emerging democracies. Since the 1998 transition from authoritarianism, Indonesia has experienced democratic consolidation alongside persistent challenges, including corruption, weak rule of law, and elite domination of political institutions (Aspinall & Mietzner, 2019).

Youth political exclusion represents a particular concern. Citizens aged 18–39 constitute 52% of the population (approximately 140 million people) yet hold minimal representation in elected office, bureaucratic leadership positions, or formal political party structures (Badan Pusat Statistik, 2024). Voter turnout among young Indonesians has declined since democratization, while trust in political institutions remains low (Mujani & Liddle, 2015).

However, Indonesian youth demonstrate capacity for political mobilization when they perceive authentic opportunities for influence. Student movements played crucial roles in the 1998 democratic transition and the 2019–2020 protests against labor law reforms and attempts to weaken anti-corruption institutions (Aspinall, 2012; Ardiyanto, 2021; Ramadlan & Aminuddin, 2025). This pattern suggests that youth 'apathy' may reflect rational assessment that conventional political channels offer minimal influence rather than inherent disinterest in governance.

Indonesian universities occupy ambiguous positions in this landscape. Elite institutions historically produced political and bureaucratic leaders, yet contemporary curricula emphasize technical expertise over civic engagement (Parker & Raihani, 2011). Whether higher education may contribute to democratic vitality rather than elite reproduction remains an open question. Given this background, this exploratory study addresses three questions: (1) What policy issues do students prioritize when given agency to select their own advocacy topics? (2) What civic capabilities do students develop through authentic policy advocacy practice? And (3) How do students describe changes in their civic identities and political efficacy?

2. Literature Review

2.1. Traditional Civic Education and the Knowledge–Action Gap

Research on civic education has long demonstrated a persistent disjunction between what students know about democracy and how they act within it (Galston, 2001; Torney-Purta et al., 2001). Traditional civic education, which emphasizes transmission of factual knowledge about institutions, procedures, and constitutional principles, reliably increases students' cognitive understanding of political systems yet fails to generate durable changes in political participation, civic efficacy, or sustained engagement (Galston, 2001; Torney-Purta et al., 2001). Meta-analytic and longitudinal studies confirm this pattern. Students emerge better informed about government structures and democratic norms but remain largely disengaged from political action beyond the classroom (Niemi & Junn, 1998; Dudley & Gitelson, 2002). This "knowing without doing" paradox has troubled civic education scholarship for decades. Even when students can articulate democratic ideals and analyze policy processes with sophistication, such competencies do not translate into participation in collective decision making or political mobilization (Levinson, 2012). The durability of this gap suggests that the core problem in civic education is not a lack of information but the absence of conditions that enable students to act politically.

2.2. Experiential and Service-Learning Approaches

In response to these limitations, scholars and educators have increasingly turned to experiential and service-learning approaches that emphasize participation, reflection, and engagement beyond conventional classroom instruction. A substantial body of evidence indicates that such approaches outperform traditional instruction on a range of civic outcomes. Celio et al. (2011), in a meta-analysis of 62 studies, report significant positive effects on civic attitudes, civic skills, and civic behaviors. These findings appear to support the claim that learning through experience produces more robust civic outcomes than learning through instruction alone.

However, critical scholarship raises concerns about the form and substance of many experiential interventions. Service-learning programs often position students as privileged providers of assistance to marginalized communities rather than as political actors engaged in collective problem solving (Mitchell, 2008). This helper orientation risks reinforcing social hierarchies and depoliticizing structural problems. Moreover, many experiential activities take place in highly managed settings such as classroom simulations or preselected service sites, where outcomes are limited in scope

and consequences remain minimal. As Gee (2003) argues, when participants recognize that an activity lacks real stakes, the psychological and motivational dynamics differ fundamentally from those present in authentic practice. Under such conditions, experiential engagement may produce short-term attitudinal shifts without cultivating capacities that transfer to real political contexts.

Experiential learning theory offers important insight into why experience matters, yet it also reveals the limits of experience alone. Kolb's (1984) model emphasizes iterative cycles of concrete experience, reflection, conceptualization, and experimentation as the basis of deep learning. This framework builds on Dewey's (1916) argument that democratic education must involve participation in democratic practice rather than abstract study of democratic ideals. Applied to civic education, experiential learning theory suggests that students develop understanding through action and reflection rather than prior knowledge acquisition.

Empirical research on youth political participation aligns with this claim (Galston, 2001; Torney-Purta et al., 2001). Longitudinal studies show that direct engagement in political activities during adolescence predicts adult civic involvement more strongly than civic knowledge or formal instruction (Youniss et al., 2002). Participation in voluntary associations that pursue collective goals also generates lasting increases in political engagement across the life course (McFarland & Thomas, 2006). Yet experiential learning theory remains largely procedural. It explains how learning occurs through experience but does not specify whether educational environments expand students' real opportunities to act as political agents beyond the learning setting itself.

Evidence suggests that the most durable effects of experiential civic engagement operate through identity formation rather than attitude change alone (Galston, 2001; Torney-Purta et al., 2001). Through sustained participation in authentic political activity, young people come to view themselves as legitimate political actors with the right and capacity to influence collective outcomes (Wray-Lake & Sloper, 2016). This identity shift alters how individuals perceive their relationship to political institutions and their own sense of agency within them. However, identity transformation depends on the availability of genuine opportunities to exercise agency. Experiences that are tightly scripted, externally controlled, or symbolically political may fail to produce such shifts. This limitation points to the need for a framework that evaluates civic education not only in terms of experience or participation but in terms of the freedoms that educational settings actually enable.

2.3. Theoretical Framework: The Capability Approach

The capability approach provides such a framework by reorienting evaluation from resources and outcomes toward substantive freedoms. Sen (1999) defines capabilities as the real opportunities individuals have to achieve valued ways of being and doing. From this perspective, education should be assessed by what students become able to do rather than by what they know or what outcomes they produce. Nussbaum (2011) identifies political participation as a central human capability that underpins dignity and democratic self-governance. Applied to civic education, this approach implies that instruction which transmits knowledge or facilitates participation without expanding students' freedom to act politically fails to meet its normative purpose (Walker & Unterhalter, 2007). Civic capability, understood in this sense, encompasses analytical capacities to understand policy problems and power relations, communicative capacities to articulate claims and engage deliberatively, relational capacities to build coalitions and sustain collective action, and agential capacities grounded in self-efficacy and a sense of political entitlement (Robeyns, 2005).

A capability-based perspective clarifies why many experiential and service-learning interventions produce limited or uneven effects. When students participate without autonomy over issue selection,

strategy, or goals, their capability sets remain constrained even if participation occurs. Capability-enhancing pedagogy, therefore, requires educational environments that allow students to exercise political agency in authentic contexts, with meaningful choices and real consequences. Following Sen's (1999) emphasis on agency as intrinsically valuable, such pedagogy must treat students not as implementers of predefined activities but as authors of political action. The objective is not merely to generate participation or measurable civic outcomes but to expand students' real freedoms to engage in collective self-governance if they choose to do so. From this standpoint, students who acquire civic capabilities yet opt not to participate politically have still experienced capability expansion, whereas students who remain unable to act despite motivation experience a form of civic capability deprivation.

3. Method

3.1. Research Design

This study employs an exploratory mixed-methods case study design (Yin, 2014). The case study design was adopted because the living lab model constitutes a bounded, context-specific intervention whose implementation logic and participant experiences cannot be adequately captured through survey or experimental methods alone. Thus, this research integrated quantitative descriptive data (campaign metrics, participation counts) with qualitative thematic analysis of artifacts and interviews. Quantitative data are reported descriptively to characterize the scope and scale of campaign activities (without applying inferential statistical tests), consistent with the study's exploratory purpose. Meanwhile, the qualitative approach (purposive interview sampling, thematic content analysis, and artifact analysis) was employed because the primary research questions concern process, meaning, and identity change, which require interpretive methods to address adequately.

3.2. Setting and Participants

The study took place in a required Policy Advocacy and Conflict Management course at Universitas Gadjah Mada, Indonesia, during the February–June 2024 semester. The course enrolled 98 undergraduate students in the Department of Public Policy and Management, distributed across two sections: a regular Indonesian-language track (n=78) and an international English-language track (n=20). Student demographics reflected the department's typical composition: 62% female, mean age 20.3 years (range: 18–24), predominantly from urban middle-class backgrounds (73%). Approximately one-third (34%) reported prior involvement in student organizations or civic groups. All students provided informed consent for participation in this research study.

3.3. Course Structure and Living Lab Design

Students formed 20 self-selected teams of 4–5 members each. Self-selection enabled students to work with peers who shared their interests while introducing potential confounds (stronger teams may have resulted from prior friendships or complementary skills rather than from pedagogy alone). Each team received one assignment: design and implement a policy advocacy campaign addressing an Indonesian public policy issue of your choice.

This open-ended charge aimed to maximize student agency while establishing several boundaries. First, campaigns must address Indonesian policy issues rather than international or global topics, ensuring local relevance and the feasibility of stakeholder engagement. Second, campaigns must focus on public policy and institutional change rather than charity or direct service provision. Third, campaigns required four deliverables: (1) a written policy analysis document (2,500–3,500 words); (2)

an online petition using the Change.org Indonesia platform; (3) a multi-platform campaign strategy; and (4) a presentation (20 minutes) documenting campaign objectives, strategies, outcomes, and lessons learned.

The semester followed four phases informed by action research methodology and experiential learning cycles. Phase 1 (foundation weeks) introduced theoretical frameworks through interactive seminars covering policy advocacy theories (advocacy coalition framework, multiple streams approach), stakeholder analysis methods (power-interest matrices, influence mapping), and conflict-sensitive engagement principles. Phase 2 (design weeks) supported campaign planning: teams selected issues through structured brainstorming, conducted initial policy analysis, mapped stakeholders, and developed campaign theories of change. Instructors provided feedback on draft documents, challenging assumptions, and identifying strategic gaps. Phase 3 (implementation weeks) constituted the core living lab experience. Teams launched petitions, created social media content, reached out to stakeholders, and adapted strategies based on responses received. Weekly coaching sessions (90 minutes) followed action research cycles: teams described actions taken, reported results observed, analyzed what worked and what did not, and planned next steps. Phase 4 (reflection weeks) emphasized structured debriefing. Teams presented campaigns that articulated not just what they did but also what they learned.

3.4. Data Collection

We employed multiple data sources to triangulate and capture both the process and outcome dimensions of civic capability development. Campaign artifacts included all team-produced written policy analyses (20 documents totaling approximately 500 pages of text plus multimedia content), online petitions, social media content (342 discrete posts: 156 Instagram, 104 Twitter/X, 82 TikTok), stakeholder communications, and final presentation materials. These underwent qualitative content analysis examining: issue framing and problem definition, quality of evidence mobilized, sophistication of stakeholder analysis, strategic coherence, ethical considerations articulated, and rhetorical tactics employed.

Campaign metrics included quantitative outcome indicators: petition signature totals (updated weekly), social media engagement, media coverage, stakeholder responses, and documented policy impacts. Following course completion and grade submission—to minimize coercion—we conducted individual semi-structured interviews with 35 students from all 20 teams via stratified purposive sampling, ensuring representation across teams, language tracks, and levels of visible engagement. Interviews averaged 75 minutes (range: 45–110 minutes) and explored motivations for issue selection, perceived skill development, challenges encountered, changes in civic identity and political efficacy, and critical assessment of the living lab model. The instructor maintained detailed weekly field notes documenting team dynamics, strategic decision-making processes, ethical dilemmas, and pedagogical interventions. Additional materials included early brainstorming documents, draft stakeholder maps with instructor feedback, peer review comments, and individual reflection papers (500 words) from each student.

3.5. Data Analysis

Campaign artifacts underwent content analysis to identify issue domains, advocacy goals, stakeholder strategies, and rhetorical framing. Campaign metrics were catalogued descriptively. Interview transcripts were analyzed using thematic analysis following Braun and Clarke (2006). Initial open coding identified recurring patterns in student responses. Focused coding grouped these into higher-order themes. Member checking was conducted with six participants to assess the

interpretive accuracy of preliminary thematic findings. All qualitative data were managed using ATLAS.ti. We triangulated findings across data sources, looking for convergence and divergence. Where student self-reports conflicted with campaign artifacts or instructor observations, we noted these discrepancies rather than privileging one source.

4. Findings

Across 20 teams and 98 students, this study documents three broad sets of findings. First, students concentrated their policy advocacy on governance accountability and social justice issues (70% of campaigns), with 65% of campaigns motivated by personal or family exposure to policy failures. Second, all teams demonstrated evidence of policy analysis and public communication capabilities; most teams (85–95%) developed digital advocacy and stakeholder engagement capabilities, while coalition building (40%) and ethical negotiation (55%) were less universal but emerged when situational demands required them. Third, interview data (n=35) suggest that many students (74%) experienced shifts in civic identity, moving from political observers to political actors, with reported increases in political efficacy tied more strongly to external recognition by institutional actors than to instructor feedback. Where the following sections present descriptive patterns derived from campaign artifacts and metrics, readers should note that interpretive claims about capability development and identity change are drawn from qualitative interview analysis and are necessarily more tentative. Causal claims are not warranted given the study's exploratory, single-site design and lack of a comparison group.

All 20 teams successfully completed their campaigns, demonstrating the basic feasibility of the living lab model. Collectively, students generated 127,450 petition signatures (range: 423–34,670 per campaign; median: 4,235). Teams produced 342 social media posts, sent 167 stakeholder communications, and secured 8 formal meetings with government officials or civil society organizations. Three campaigns reported achieving tangible policy outcomes: strengthened enforcement of municipal smoke-free zones in Yogyakarta, increased access to disability services at the university, and modifications to local public transportation routes to improve accessibility. While we cannot definitively establish causality between student campaigns and these changes, stakeholders acknowledged student advocacy in policy discussions.

Analysis of campaign topics reveals distinct patterns in student policy priorities (Table 1). Governance and institutional accountability issues dominated, comprising 45% of campaigns (9 of 20). These included advocating against military involvement in civilian state enterprises, demanding anti-corruption legislation, critiquing structural inefficiencies in government, and challenging proposed expansions of military legal authority. Social justice and labor rights campaigns accounted for 25% (5 of 20), focusing on marginalized populations, including disability inclusion in education, social protection for informal workers, age-based employment discrimination, and teacher wage equity. Urban infrastructure campaigns constituted 20% (4 of 20), addressing everyday service failures: pedestrian safety, public transportation adequacy, and smoke-free zone enforcement. Environmental justice campaigns appeared in 10% (2 of 20) of cases, addressing land conflicts and forest protection.

Table 1 ***Distribution of Campaign Topics by Policy Domain (N=20)***

Policy Domain	Campaigns	Percentage
Governance & Accountability	9	45%

Policy Domain	Campaigns	Percentage
Social Justice & Labor Rights	5	25%
Urban Infrastructure	4	20%
Environmental Justice	2	10%
Total	20	100%

Interview data revealed that 65% of campaigns (13 of 20) were motivated primarily by students' direct experiences with policy failures—either personal encounters or close observation of injustice affecting family members or community members. As one student explained:

> "My aunt is an informal food vendor, which means she doesn't have access to benefits like insurance or a pension. When she fell ill, the financial impact on my family was huge. I admit, I used to view that as just a private family issue. However, this course shifted my perspective entirely. I now understand it as a structural problem...[specifically], how policy choices often exclude workers like her from the protections that formal employees receive."

This distribution contradicts the common assumption that young people primarily care about lifestyle or identity issues, divorced from governance structures. Instead, student priorities centered on institutional accountability, systemic reform, and the protection of vulnerable populations—issues that require confronting entrenched interests and fundamental shifts in power. It should be noted, however, that this relationship between issue selection and personal experience was based on self-report data collected at the end of the course; it may reflect post hoc attribution rather than a preexisting primary motivation.

4.1. Civic Capability Development

Document analysis combined with interview data indicates that students developed civic capabilities across six domains (Table 2). Evidence for these capabilities comes from triangulation of campaign artifacts, interview transcripts, and instructor observations collected over the semester. These capabilities did not develop in a uniform or linear manner. Some appeared early and deepened through repeated use, while others remained uneven or context-dependent and were only partially articulated by students.

Table 2 ***Evidence of Civic Capability Development Across Teams (N=20)***

Capability Domain	Teams (N=20)	Percentage
Policy Analysis	20	100%
Digital Advocacy	19	95%
Stakeholder Mapping & Engagement	17	85%
Ethical Negotiation	11	55%
Coalition Building	8	40%
Public Communication	20	100%

Policy analysis was the most consistently observable capability across teams. All groups identified a policy problem, moved beyond surface description, and proposed at least one plausible intervention in their written briefs. Although the quality of analysis varied substantially, comparisons between early drafts and final submissions show improvement in most cases. Instructors also observed that policy analysis did not remain confined to the briefing stage. As campaigns unfolded, teams revisited their problem definitions in response to stakeholder feedback and implementation constraints. In some cases, this process narrowed the focus of the campaign; in others, it led to a reframing of the policy problem itself.

Digital advocacy developed less predictably. Nineteen teams (95%) made sustained use of social media, but few began with a clear understanding of how different platforms function politically. Interview data show that awareness of platform differences emerged primarily through experimentation rather than prior knowledge or formal instruction. Students often described changing content or tone after observing limited engagement, but were not always able to explain why those changes mattered. One student remarked, "We just saw that some posts didn't get any response, so we stopped doing that." Over time, several teams began to distinguish between content aimed at public attention and materials intended for policy-facing audiences, though this distinction often remained implicit rather than analytically explicit.

Questions of influence became more salient as campaigns progressed, which led to the development of stakeholder mapping and engagement capabilities. Seventeen teams (85%) produced stakeholder maps that identified relevant actors and their interests. Early versions of these maps frequently prioritized actors who shared the team's normative position. This pattern reflected an initial tendency to equate agreement with political importance. Instructor feedback and stalled outreach efforts prompted some teams to revise this approach and focus on actors with decision-making authority or indirect leverage. These shifts usually occurred after campaigns encountered obstacles rather than through advanced strategic planning.

The military enterprise campaign illustrates this pattern. The team initially concentrated outreach on civil society groups that already opposed military involvement in commercial activities. When this strategy produced little movement, the team redirected attention toward business associations and reform-oriented officials whose interests only partially overlapped with the campaign's normative goals. Although the campaign did not result in policy change, the reorientation itself reflected a more strategic understanding of influence. As one student noted, "…[we] realized we were mostly talking to people who already agreed with us, and that didn't really go anywhere."

Coalition-building was less common and more uneven. Eight teams (40%) worked with external organizations during the semester, most often in policy areas where established civil society actors were involved. Students involved in these campaigns described coalition work as difficult to sustain within a single semester. Several reported challenges related to coordination, differing priorities, and limited responsiveness from partner organizations. In contrast to policy analysis or digital advocacy, coalition building often remained fragile and contingent. This pattern suggests—tentatively, given the small number of cases—that coalition capacity may require longer time horizons and institutional continuity that short-term living labs cannot easily provide.

Ethical negotiation emerged most clearly when campaigns encountered competing claims that could not be resolved through technical fixes. Eleven teams (55%) faced such tensions. In the sidewalk regulation campaign, the team initially framed the issue in terms of pedestrian safety and accessibility. Engagement with street vendors complicated this framing by highlighting the livelihood consequences of enforcement. Students described this moment as unsettling rather than clarifying.

One student stated, “After talking to them [street vendors], it didn’t feel like there was a clean solution anymore.” The team ultimately proposed differentiated regulation that combined stricter enforcement in high-risk areas with greater flexibility elsewhere. While the proposal did not resolve the underlying conflict, it reflected an effort to confront ethical trade-offs rather than avoid them.

Public communication was a universal requirement, but showed substantial variation in development. All teams presented their campaigns publicly, and most demonstrated greater familiarity and confidence over time. Improvement, however, was uneven. Some students became more effective speakers as they gained command of their material, while others remained hesitant despite strong substantive work. This variation suggests that public communication may be less responsive to short-term experiential learning than analytical or strategic capabilities and may depend more strongly on prior experience and cultural norms.

4.2. Civic Identity Transformation

Interview analysis points to three patterns of change in civic identity, though these shifts were neither uniform nor complete among students. To note, however, these patterns are drawn from self-report data and should be interpreted as accounts of subjective experience rather than objectively verified transformation. Their durability beyond the course cannot be assessed from the present data. Rather than reflecting a wholesale transformation, identity change appeared episodic and closely tied to moments of interaction with political institutions and actors.

A first pattern involved a shift from political observation to political action. Many students (26 of 35 interviewed, 74%) described a change in how they understood their relationship to politics. Prior to the course, they tended to position themselves as observers or as future participants whose political relevance would come later. Campaign experience altered this perception for some students, particularly when their outreach elicited responses from officials or organizations. As one student explained, “When they actually replied to our letters and agreed to meet, even though they didn’t support what we wanted, it felt like they were treating us as real actors.” For these students, recognition by institutional actors mattered more than agreement. It disrupted the assumption that political voice is reserved for those with age, status, or formal authority.

A second pattern related to confidence, which students frequently tied to demonstrated competence rather than encouragement. Many contrasted abstract affirmations with the experience of producing work that others took seriously. One student noted, “It’s different when someone says you’re capable and when you see that people actually read what you wrote.” Confidence in this sense emerged unevenly and often late in the semester. It appeared strongest among students who completed tangible outputs such as policy briefs or meetings with stakeholders.

A third pattern involved a more realistic understanding of political change. Students described learning that advocacy is slow, contested, and shaped by power asymmetries. Several noted frustrations with resistance from officials or the limited impact of their efforts. At the same time, this realism did not translate into disengagement. Instead, some students reported feeling more prepared to engage because their expectations had shifted. As one student put it, “I don’t think change is easy anymore, but at least now I know what makes it hard.” This suggests that exposure to political constraint can coexist with sustained motivation, provided students interpret difficulty as structural rather than personal failure.

Across interviews and course materials, three pedagogical features appear to be associated with these outcomes. These mechanisms operated unevenly across campaigns and interacted with one another rather than functioning independently. First, authentic stakes mattered. Students

consistently described investing more effort in campaigns than in typical coursework because their actions had consequences beyond grading. Accountability to external audiences, rather than to instructors alone, appeared to motivate greater care and persistence. Second, failure functioned as a learning opportunity under specific conditions. Several teams encountered setbacks, including unresponsive stakeholders, ineffective tactics, or strategic misjudgments. Because the assessment emphasized learning processes rather than outcomes, these experiences did not automatically translate into penalties. Teams that revisited failed strategies and adjusted their approach often reported deeper learning than teams whose campaigns proceeded smoothly. Third, agency over issue selection played a central role. Students' ability to choose advocacy topics shaped both persistence and emotional investment. Interviews indicate that campaigns connected to personal experience or local observation generated stronger commitment, especially when progress was slow.

5. Discussion

These findings challenge dominant explanations of youth political disengagement that rely on claims of apathy. The apathy thesis attributes low participation to generational narcissism, digital distraction, or weak civic motivation (Putnam, 2000; Twenge, 2017). This framing has shaped civic education and policy interventions for decades. Most responses emphasize inspiration through improved curricula, engaging instructional formats, or gamified participation platforms. Despite sustained investment, these approaches have produced limited and short-lived behavioral effects (Manning & Edwards, 2014).

The evidence presented here supports a different interpretation. When institutional barriers were reduced, and students were given genuine authority to act on policy issues they considered meaningful, participation was neither minimal nor reluctant. Students devoted time and effort well beyond standard coursework expectations. Many persisted despite repeated setbacks. Several articulated intentions to remain civically active after course completion. These patterns are inconsistent with explanations rooted in motivational deficit.

Student issue selection further undermines the apathy narrative. Rather than concentrating on lifestyle or symbolic identity concerns, nearly half of all campaigns focused on governance accountability and institutional reform. These issues required engagement with complex regulatory structures and confrontation with entrenched power relations. Campaigns addressed military involvement in state enterprises, anti-corruption legislation, and bureaucratic inefficiency. Such choices are difficult to reconcile with claims of political indifference.

However, this interpretation aligns with scholarship that reframes youth disengagement as a rational response to exclusionary political systems rather than individual failure (Cammaerts et al., 2014; Harris et al., 2010). When participation mechanisms offer voice without influence or consultation without authority, withdrawal is a reasonable response. The central problem is, therefore, not about insufficient motivation but institutional designs that suppress civic capability. Under these conditions, efforts to inspire participation misdiagnose the source of disengagement.

5.1. From Lived Experience to Political Action

A notable finding is that 65% of campaigns originated from students' direct encounters with policy failures affecting them, their families, or their communities. This "pain-to-policy" trajectory has implications for both civic motivation and pedagogical design. Here, Freire's concept of conscientization provides a useful interpretive lens (Freire, 1970). Students were not indifferent to injustice. They lacked analytic frameworks that connected personal hardship to structural decision-making. Once equipped with policy tools, students reframed experiences such as informal labor

precarity, disability exclusion, and wage violations as outcomes of deliberate institutional choices rather than private misfortune.

This pattern complicates dominant service-learning models. Conventional service-learning often positions students as helpers addressing problems experienced by others (Mitchell, 2008). In contrast, the living lab model placed students in the position of affected stakeholders. This shift appears central to the depth of engagement observed. Emotional investment was not produced by empathy alone but by proximity to harm.

At the same time, this dynamic raises equity concerns. Students from marginalized backgrounds may bear heavier emotional burdens when coursework draws directly on personal or familial trauma. Without adequate safeguards, such pedagogy risks reproducing inequality within the classroom. Future implementations must balance authenticity with care, while also ensuring that more privileged students confront structural injustice beyond their immediate experience.

5.2. Capability Development Through Authentic Practice

The breadth of capability development observed across six domains supports claims from experiential learning theory that competencies emerge through practice rather than instruction alone (Dewey, 1916; Kolb, 1984). The mechanism, however, extends beyond simple exposure to activity. First, authentic stakes played a decisive role. Students invested effort because campaigns had real-world consequences. They interacted with actual citizens, organizations, and officials. Accountability extended beyond the instructor. One student stated that careless work would mislead people who trusted them enough to sign a petition. External responsibility altered the meaning of academic performance in ways that simulated exercises rarely achieve (Newmann et al., 2007).

Second, failure functioned as a learning catalyst when the assessment focused on reasoning and adaptation rather than outcomes. Several teams encountered resistance, strategic misjudgments, or public disengagement. A grading system tied to campaign success would have penalized these experiences. Process-oriented assessment made failure analytically productive (Kapur, 2008). Teams that revised strategies after setbacks often demonstrated the strongest learning outcomes.

Third, capability development varied across domains. Policy analysis and digital advocacy were nearly universal. Coalition building and ethical negotiation appeared in fewer than two-thirds of campaigns. This variation reflects the issue's characteristics rather than an instructional omission. Some campaigns did not require alliances or value trade-offs. The implication is that a single living lab cannot guarantee uniform acquisition of capabilities. Competencies develop in response to situational demand rather than curricular intent.

5.3. Civic Identity and Political Efficacy

The most consequential outcome is the reported shift in civic identity. Students moved from viewing political participation as a future possibility to recognizing themselves as current political actors. This change corresponds to Bandura’s concept of mastery experience, which identifies successful task completion as a primary source of self-efficacy (Bandura, 1997). In this research, students distinguished sharply between encouragement and evidence. Being told they had political potential carried limited weight. Producing work that external actors treated as legitimate had a different effect. Writing policy briefs that received responses, engaging officials who replied substantively, and interacting with journalists provided concrete confirmation of competence.

This distinction clarifies why information-based civic education often fails to build efficacy. Verbal affirmation is weaker than demonstrated capacity. However, external recognition was central to this process. Responses from government agencies, civil society organizations, and media actors

signaled legitimacy that instructor feedback could not replicate. Civic identity shifted through social acknowledgment rather than internal reflection alone.

To note, however, these findings require caution. Self-reported identity change may reflect social desirability bias, especially in instructor-led research contexts. The absence of longitudinal data prevents assessment of durability after graduation. It also remains unclear whether similar transformations could emerge in conventional civic education under optimal conditions. These limitations position the findings as suggestive rather than definitive.

5.4. Implications for Political Science Education

If corroborated by further research, living labs offer several advantages for political science education. The model is adaptable across course types and institutional contexts without extraordinary material investment. While instructor workload is substantial, the essential components remain transferable.

Living labs also address the long-standing tension between content coverage and skill development. Theory and practice are not sequenced but integrated. Students acquire policy frameworks while simultaneously applying them. This integration may be more pedagogically efficient than treating analytical knowledge and civic skill as separate objectives.

More fundamentally, living labs reposition universities as arenas of democratic practice rather than sites of detached observation. When student campaigns produce measurable policy effects, universities become participants in democratic processes. This orientation aligns with conceptions of engaged scholarship and public work pedagogy (Boyer, 1996; Boyte, 2004).

5.5. Broader Implications for Democracy and Development

Beyond pedagogy, these findings speak to democratic participation in emerging democracies. Indonesia combines a large youth population with democratic stagnation and narrowing civic space. Whether this demographic configuration yields renewal or instability depends on the development of political capability. From a capability perspective, exclusion from meaningful participation constitutes developmental failure regardless of economic performance (Sen, 1999). Civic education that expands political agency, therefore, serves development objectives rather than educational ones alone.

The prominence of governance reform in student campaigns suggests unmet demand for systemic change among educated youth. Universities that cultivate such capacity may contribute to democratic vitality. This potential depends on institutional leadership and political tolerance. Neither can be assumed where youth mobilization threatens established interests.

6. Conclusion

This exploratory study provides preliminary evidence that living lab pedagogy—student-designed policy advocacy campaigns—may offer a promising approach to civic capability development in political science education. While methodological limitations preclude strong causal claims, the findings suggest that authentic advocacy practice can develop multiple civic competencies and transform how students understand themselves as political actors.

The living lab model warrants further investigation through more rigorous research designs. If subsequent studies confirm these preliminary findings, the approach could offer political science educators a scalable framework for transforming higher education institutions from sites of civic knowledge transmission to laboratories for democratic practice.

6.1. Limitations

This study has significant limitations that constrain interpretation. First is the absence of a comparison group. Without a control condition, no causal claim can be made about the specific contribution of living lab pedagogy. Observed changes may reflect normal developmental trajectories, exposure to course content independent of the living lab format, or unobserved contextual factors.

Second is the dual role of instructor and researcher, which introduces additional risk of response bias. Students may have reported favorable experiences to align with perceived instructor expectations or to express gratitude for course support. Although data collection occurred after course completion and involved external interviewers, these safeguards cannot eliminate social desirability effects. Reported identity shifts and capability gains should therefore be interpreted with caution.

Third, the study also lacks longitudinal evidence. Outcomes were measured at the end of a single semester. It remains unknown whether reported capabilities or transformations in civic identity persist once students leave the structured university environment. Follow-up surveys are planned at six months, but these data are not yet available. Claims about durability must therefore remain provisional.

Fourth, generalizability is limited. The analysis draws on a single course at one “elite” Indonesian university. Institutional resources, student selectivity, and political context likely shaped both implementation and outcomes. Results may not transfer to less resourced institutions, different national settings, or student populations facing higher political risk. The model may function differently under conditions of repression or material constraint.

6.2. Future Research Directions

Given these limitations, future research should address these weaknesses directly. Priority directions include: (1) experimental or quasi-experimental designs that compare living lab pedagogy with conventional instruction; (2) longitudinal studies that observe participants over extended periods to assess durability of capability and identity change; (3) replication across varied institutional and political contexts to test generalizability; (4) more rigorous measurement strategies assessing capability development through validated instruments and observable behaviors rather than self-report alone; and (5) attention to equity implications, examining whether the model produces differential outcomes for students from marginalized versus privileged backgrounds.

7. Declarations

7.1. Author Contributions (CRediT)

The author solely conceived the study, designed the methodology, conducted the analysis, interpreted the results, and wrote the manuscript.

7.2. Conflict of Interest

The author declares no conflicts of interest.

7.3. Funding Statement

The author declares that the study received no funding.

7.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request, subject to participant confidentiality agreements.

7.5. Ethics Approval

N/A

7.6. Use of Artificial Intelligence (AI) Tools

This manuscript was reviewed with the assistance of an AI tool (Google Gemini) for language editing and stylistic refinement only. The study design, data, analysis, and conclusions are entirely original and produced by the author.

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Ideology and curriculum in social studies education: The case of Cuba

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ABSTRACT

Political ideologies play a decisive role in shaping national education curricula, as governments' ideological orientations directly influence educational policies and curricular frameworks. In this sense, social studies curricula cannot be understood merely as neutral technical instructional plans; rather, they function as ideological texts constructed in accordance with political power relations, societal priorities, and dominant ideological discourses. Accordingly, this study examines the official secondary-level curricula for Geography, History, and Citizenship Education in the Republic of Cuba, where these subjects serve as equivalents of social studies within a socialist ideological context. The data sources consist of official curriculum documents published by the Cuban Ministry of Education and retrieved from its official website (2020–2021 curriculum documents). Using document analysis as a qualitative research method, the study conducts a close reading of the curriculum texts, focusing on the objectives, thematic content, and value orientations presented in these curricula. The analysis explores how socialist ideological orientations are reflected in the curricula through themes such as citizenship values, anti-imperialist discourse, collective responsibility, and national identity. In Cuba, the education system operates as a key mechanism for the reproduction and consolidation of socialist identity and state ideology. The curricula aim to cultivate values such as collective responsibility, solidarity, peaceful conflict resolution, and socialist citizenship, thereby contributing to the formation of ideologically aligned subjectivities. From this perspective, the curricula seek not only to enhance students' cognitive knowledge but also to construct a holistic conception of citizenship grounded in socialist values. The curricula also emphasize educating students to be productive, conscious individuals capable of critically engaging with both national and global realities and contributing to processes of social transformation. In conclusion, school curricula are important carriers of ideological messages. Therefore, social studies constitute a critical field of inquiry in which not only what should be taught but also why, how, and for whom it should be taught must be systematically examined.

KEYWORDS: Social studies education; Citizenship education; Ideology and education; Curriculum analysis; Republic of Cuba

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1. Introduction

Social studies is widely regarded as one of the most comprehensive school subjects. Stanley and Nelson (1994, p. 266), for instance, conceptualise social studies education as "the study of all human

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activities in time and space." Determining what should be included in the social studies curriculum necessitates engagement with fundamental questions about how social knowledge, skills, and values should be organised across subject areas and disciplines (e.g., history, geography, anthropology), as well as the diverse subjectivities of teachers and students. In this respect, it is unsurprising that intellectual debates concerning the purposes, content, and pedagogical orientations of social studies have persisted since its emergence as a school subject in the early twentieth century (Castro & Knowles, 2015; Ross, 2024).

Although there is a broad, superficial consensus in the literature that the purpose of social studies is to equip young people with the knowledge, skills, and values required for active participation in society, substantial disagreements among social studies educators persist over curriculum content and the meaning of "good citizenship." In debates on what it means to be a "good citizen," scholars have advanced competing arguments concerning how students can develop citizenship competencies. These perspectives suggest that students may acquire citizenship not only through the study of history—long privileged within the field—but also through engagement with contemporary social issues, public policies, social roles and taboos, critical examination of their own societies, and participation in pedagogical and political struggles for social and racial justice (Ross, 2024). Consequently, the content and pedagogical orientations of social studies education are profoundly shaped by broader social and political agendas.

The National Council for the Social Studies (NCSS), the principal professional organisation for social studies educators in the United States, revised its definition of social studies in 2023 as a field of study that examines individuals, communities, and systems, and their interactions across time and space, with the goal of preparing students for local, national, and global civic life. Within this framework, social studies is conceptualised as an inquiry-based field that enables students to examine human experiences through questioning, gathering and analysing evidence from reliable sources, considering multiple perspectives, and applying disciplinary tools and methods. It is further emphasised that social studies prepare students for lifelong civic discourse and participation by engaging them with the past, enabling critical engagement with the present, and empowering them to shape the future. Moreover, the field is positioned as centring on human rights knowledge and multi-level responsibilities, thereby equipping students to contribute collaboratively to creating a more just world.

Conceptualising social studies as a field aimed at equipping students with knowledge of human rights and multi-scalar civic responsibilities inevitably raises broader theoretical discussions about the nature of the curriculum. In general terms, curriculum can be defined as a dynamic framework encompassing all learning experiences planned and guided by schools to achieve educational goals. Taba (1974, cited in Soto, 2015) characterises curriculum as a "learning plan," conceptualising it as a holistic design rather than a mere list of content topics. However, curriculum is not limited to the transmission of facts and generalisations derived from the social sciences. At this point, the concept of curriculum ideologies becomes analytically central. Ideology can be understood as a constellation of beliefs, attitudes, and understandings shared within a society—a system of assumptions regarding what is considered valuable, correct, desirable, normal, or natural. Ideologies not only explain educational goals and policy decisions but also legitimise and normalise practices and power relations. Dominant or hegemonic ideologies often become "invisible," constructing understandings of how the world is and ought to be as natural and unquestionable (Ross, 2024).

School curricula are among the most significant carriers of ideological messages. Political ideologies exert a decisive influence on the development of national education curricula; governments'

ideological orientations directly shape educational policies, curriculum frameworks, and resource allocation, often leading to curriculum reforms and restructuring (Soto, 2015). Accordingly, social studies curricula cannot be understood merely as technical instructional plans; rather, they are shaped by ideological preferences, societal goals, and the orientations of political power. From this perspective, analysing curricula across different national contexts is crucial for revealing divergent conceptualisations of the nature, philosophical and theoretical foundations, purposes, and pedagogical implementations of social studies.

Grounded in this theoretical framework, the present study examines the curricula for Geography, History, and Citizenship Education taught at the secondary level in the Republic of Cuba, which serve as equivalents of social studies. Cuba was considered a valuable case for analysis due to both the absence of prior studies examining social studies–equivalent curricula at the secondary level in the Cuban context and the country's explicitly socialist ideological orientation. Following the 1959 Revolution, the Cuban education system was reorganized in accordance with socialist ideology, adopting a centralized and state-controlled structure, and education was defined as a constitutional right and made free at all levels. In Cuba, the primary objective of educational policy is not only to enhance academic achievement but also to strengthen social equality and cultivate individuals with a strong sense of collective responsibility (Carnoy, Gove, & Marshall, 2007; Baldan, 2017). Accordingly, the system is built upon the principles of equal opportunity and public responsibility and is supported by policies aimed at reducing educational disparities between rural and urban areas (Gasparini, 2011). Moreover, international comparative studies indicate that Cuban students demonstrate relatively high levels of academic achievement, particularly in mathematics and reading, compared with many other countries in Latin America (Carnoy et al., 2007; UNESCO, 2015).

Within this broader educational context, the present study investigates how socialist ideology is reflected in the curricula of Geography, History, and Citizenship Education and how these ideological orientations are concretized through curricular objectives, content structures, and pedagogical approaches. In doing so, the study critically interrogates the curriculum not merely as a pedagogical text but also as an ideological text and a site of discourse production within the field of social studies education. Accordingly, the study seeks to address the following research questions: (1) How are the objectives and thematic content of the Geography, History, and Citizenship Education curricula at the basic secondary level in Cuba structured? (2) How is socialist ideological orientation reflected in the objectives, content, and value dimensions of these curricula? (3) What type of citizenship understanding is constructed through these curricula, and which values and themes underpin this construction?

2. Method

2.1. Research Design

This study adopts a qualitative research design and employs document analysis as the primary research method. Document analysis is a systematic procedure for reviewing and interpreting written documents to gain understanding and develop empirical knowledge about a specific phenomenon (Yıldırım & Şimşek, 2021). In this study, document analysis was used to examine how ideological orientations are embedded in official curriculum documents. The study focuses on the basic secondary-level curricula for Geography, History, and Citizenship Education in the Republic of Cuba, where these subjects serve as equivalents of social studies within the national education system. The analysis aims to identify how socialist ideological orientations are reflected in the objectives, content structures, and value dimensions of these curricula.

The data corpus consists of official curriculum documents published by the Cuban Ministry of Education (ME). Specifically, the study analyses curriculum documents prepared for the 2020–2021 academic year under the framework of Curriculum Adaptations for the 2020–2021 Academic Year: Basic Secondary Education. The following curriculum documents were included in the dataset: Geography curriculum (Grade 8); Geography of Cuba curriculum (Grade 9); Ancient and Medieval History curriculum (Grade 7); Modern and Contemporary History curriculum (Grade 8); History of Cuba curriculum (Grade 9); Citizenship Education / Civic Education curricula (Grades 7–9). These documents were selected because they represent the core subjects in the basic secondary education level that correspond to the domain of social studies education. All documents were retrieved from the official website of the Cuban Ministry of Education. The original language of the curriculum documents analysed in this study is Spanish. To facilitate the analysis, the researchers translated the texts into English using three AI-assisted translation tools. The resulting translations were examined comparatively and cross-checked to ensure semantic consistency and terminological accuracy. In addition, key terms were revisited in the original Spanish texts to prevent conceptual shifts in meaning and maintain terminological consistency throughout the analysis.

2.2. Data Analysis

The data analysis in this study was conducted using a descriptive and interpretive document analysis approach. The curriculum documents were examined through close reading in line with the research questions. In the analytical process, the primary units of analysis consisted of the curriculum objectives, thematic content, and value orientations related to citizenship presented in the curriculum documents. The curriculum texts were read multiple times to identify the curriculum's structural characteristics and ideological orientations. These elements were then interpreted in relation to the research questions. The analysis particularly focused on themes reflected in the curriculum documents, such as citizenship values, anti-imperialist discourse, collective responsibility, and national identity.

To enhance the study's trustworthiness, several methodological strategies were employed. First, the curriculum documents were examined independently by two researchers, and their interpretations were compared. Any discrepancies were discussed until consensus was reached, contributing to inter-researcher consistency. In addition, direct excerpts from the curriculum documents were included in the analysis to demonstrate the alignment between the interpretations and the original data. These excerpts allow readers to evaluate the findings directly in relation to the source texts. Furthermore, the analytical decisions and interpretation processes were systematically documented to establish an audit trail. Finally, because the original documents were written in Spanish, the translations were cross-checked against the originals to ensure terminological consistency. These procedures were implemented to strengthen the transparency and trustworthiness of the research process.

3. Findings

3.1. Geography Curriculum

3.1.1. General Objectives of the Geography Curriculum

The general objectives of the geography curriculum are expressed in the curriculum as follows (ME, 2020, pp. 104–106): (1) To establish a scientific world view through the study of geographical objects, events and processes in the continental areas of our planet. (2) To explain various physical and economic geography objects, events, and processes to understand the functioning of human-earth relations in geographical space. (3) To create awareness among students about the rational use of

natural resources and the protection of the natural environment for future generations by giving examples of the importance of natural resources. (4) To evaluate the use of natural resources on a global and Cuban scale, based on the current level of scientific and technical development and socio-economic conditions. (5) To explain the fundamental factors involved in material production. (6) To define the industrial processes and commercialisation of some of the most widely used natural resources in the world and in Cuba, considering the fundamental characteristics that characterise agricultural and industrial production, and to identify the connections between them as an expression of the material reproduction developed by human society to sustain its existence. (7) To illustrate the different branches and sectors of the economy and determine the role of contemporary industrial production in achieving high levels of economic development. (8) To contribute to understanding the role of multinational corporations as tools used by countries with advanced economies to plunder the wealth of Third World nations. (9) To explain the fundamental characteristics of transport and communication tools. (10) To understand how international economic relations have developed and to highlight the differences between economic blocs that go beyond being mere commercial/financial coordination mechanisms and operate based on justice and equality, taking into account the economic and social asymmetries of each nation, as in the case of ALBA. (11) To contribute to the development of labour, vocational, and career orientation so that students can take advantage of the opportunities offered by different areas of the economy and pursue a profession or job that is necessary for the country. (12) To strengthen the guiding role of the course in environmental education and to ensure that educational objectives in this area can be achieved at the classroom level. (13) To internalise the necessity of protecting nature and using its elements and forces wisely, thereby strengthening feelings of love for nature. (14) To develop aesthetic appreciation by appreciating the beauty of nature and the aesthetic aspects of socio-economic transformations resulting from human activities. (15) To deepen patriotism and internationalism by understanding the different socio-economic conditions that exist on our planet, particularly the conditions in Third World countries and Cuba's stance on this issue. (16) To develop teaching skills and habits such as using textbooks, geography atlases, and other resources; organising and analysing data; problem solving; independent work; self-monitoring of actions and critical evaluation of results; collective work based on honesty, respect, solidarity, and cooperation. (17) To strengthen behaviour consistent with a socialist society by demonstrating the inequality of scientific and technical development through practical activities that enable the study of different branches of the economy, continents, geographical regions, and selected countries.

When examining the general objectives of the geography curriculum, the overarching aim is to enable students to develop a scientific worldview through the study of geographical objects, phenomena, and processes across the planet's continental spaces. The curriculum emphasises explaining human–environment relationships, understanding physical and economic geographical processes, and highlighting the significance of natural resources through diverse spatial and temporal examples. From the perspective of ideological reflection in the curriculum, Articles 8, 10, 15, and 16 are particularly salient. In the curriculum, multinational corporations are presented not as neutral actors of the global economy but as instruments that reproduce the economic dominance of developed capitalist countries over the Third World. In this context, students are encouraged to critically evaluate global economic inequalities within the historical framework of colonialism and neo-colonial relations. At the same time, Cuba's post-revolutionary policies of nationalization, state control, and national sovereignty are presented as an alternative model that protects national resources and defends collective interests, with the aim of fostering an anti-imperialist sense of patriotism among students. The curriculum also addresses international economic relations as

structures reflecting different development paradigms and value systems; in particular, the example of ALBA highlights alternative forms of cooperation based on solidarity, equality, and independent development. Furthermore, by examining the socioeconomic conditions in Third World countries, the curriculum highlights the structural causes of global inequalities and seeks to cultivate a sense of internationalist solidarity among students. Finally, while the curriculum incorporates contemporary approaches to geography education aimed at developing cognitive skills such as data analysis, problem-solving, and critical evaluation, it also situates pedagogical objectives within a specific ideological framework by promoting solidarity, collective responsibility, and behaviours aligned with socialist values. In this respect, the curriculum can be understood as extending beyond the transmission of disciplinary knowledge to foster an ideologically and value-oriented conception of citizenship.

In conclusion, the Cuban geography curriculum appears to pursue a dual objective: strengthening students' national identities while constructing subjects who perceive themselves as morally and politically responsible for global inequalities. While the curriculum demonstrates a robust pedagogical structure that integrates contemporary learning skills with values education, at the ideological level, it positions geography teaching as an instrument for legitimising and reproducing a socialist worldview. This clearly illustrates that the curriculum is not merely a scientific or pedagogical text, but also an ideological construct in which objectives, content, and pedagogical methods are deeply intertwined with political and ideological goals.

3.1.2. Geography Curriculum Content

Geography is not offered as a separate subject in Grade 7 in Cuba. Geography instruction is formally introduced at the basic secondary level in Grades 8 and 9. Table 1 presents the main thematic areas and allocated instructional hours for the geography curriculum at these grade levels (ME, 2020, pp. 104–111).

Table 1 ***Geography curriculum content***

Grades	Themes	Lesson Hours
Year 8	Geography Natural Resources Material Production Study of selected continents, regions and countries of the planet	62 hours
9th Grade	Geography of Cuba Cuban Archipelago Cuba's (Physical) Geographical Appearance Economic Profile Social Profile Environmental Profile Cuba's Regions, Provinces and Counties	62 hours

The Grade 8 geography curriculum is designed to enable students to analyse natural, economic, and social processes at the global scale through a holistic perspective. The curriculum aims to foster environmental awareness by addressing fundamental concepts related to the classification, spatial distribution, and sustainable use of natural resources. In addition, by examining the spatial organisation of production activities such as agriculture, industry, and services, as well as economic relations and interregional development disparities, students are encouraged to develop an understanding of global economic and political dynamics. By relating the natural environment to

human activities through the analysis of geomorphological, climatic, and hydrological characteristics of continents, the curriculum introduces themes such as global inequality, regional integration, and sustainable development through comparative analyses of the geographical, demographic, and socio-economic characteristics of different countries. In this respect, the curriculum seeks to cultivate environmentally conscious students who can comprehend the interrelationships between economic and social processes and develop informed forms of global citizenship. Furthermore, the curriculum incorporates practical application activities across learning domains, reflecting an inquiry-based and participatory pedagogical orientation that emphasises not only cognitive outcomes but also attitudes, values, and behavioural dimensions (ME, 2020, pp. 106–108).

The Grade 9 geography curriculum in Cuba is thematically structured to enable students to analyse the country's natural, economic, and social structures from a multidimensional perspective. The curriculum initially focuses on the fundamental characteristics of the natural environment by detailing Cuba's physical geography, including geological structure, landforms, climate patterns, hydrographic features, and biogeographical elements. Building upon this natural foundation, the curriculum examines population structure, settlement patterns, economic activities, regional development disparities, and production–distribution relationships, thereby supporting students' understanding of the interactions between geographical processes and socio-economic dynamics. The curriculum further encourages students to critically evaluate agriculture, mining, energy, and industrial sectors in relation to environmental sustainability, resource management, and national development priorities. Topics such as regional integration, external economic relations, and Cuba's geopolitical positioning in the Caribbean and Latin America are also addressed, enabling students to understand the country's strategic significance in global and regional contexts. Through these thematic orientations, the curriculum contributes to the development of national geographical awareness while simultaneously fostering analytical thinking skills that allow students to assess Cuba's socio-economic structures within a global framework (ME, 2020, pp. 108–111).

In addition to disciplinary content, the curriculum places explicit emphasis on values such as patriotism, diligence, the preservation of natural and cultural heritage, research skills, orderly and hygienic work habits, respect for and protection of social property, peer solidarity, national identity consciousness, and the development of independent working habits. These objectives indicate that geography education is framed not only as a scientific discipline but also as a vehicle for civic and moral formation. Overall, the content of the Cuban geography curriculum is embedded within an ideological framework that extends beyond the teaching of physical and human geography concepts, aiming to construct a socialist, anti-imperialist, collectivist, and internationalist civic identity. Students are encouraged to engage in collective work practices and to internalise values such as honesty, respect, solidarity, and cooperation as part of their integration into socialist society. Thus, the curriculum's underlying objective is to cultivate a civic identity that reinforces the ideological foundations of the socialist state. From this perspective, geography education functions not merely as a disciplinary field but as an ideological instrument through which spatial and economic dimensions of socialist identity formation are systematically constructed.

3.2. History Curriculum

3.2.1. General Objectives of the History Curriculum

The general objectives of the history curriculum are expressed in the curriculum as follows (ME, 2020, pp. 58–59): (1) To ensure that students defend their national identity with admiration and respect for heroes, martyrs, revolutionary leaders, and national symbols. In this context, students develop informed judgements about universal history, Cuban history, and regional events and developments;

they exhibit patriotic, revolutionary, pro-Latin American, and anti-imperialist attitudes in line with the humanistic values of socialism. (2) Students are expected to adhere to the rules, norms, and objectives established in the family environment, school group, institution, and society in a self-disciplined manner; to reject all forms of discrimination, violence, and corruption by examining the historical, legal, cultural, and civic potential of universal history and the history of Cuba and the local area. (3) Students are expected to develop a scientific worldview through the systematic and comprehensive learning of information, historical connections, and contradictions related to universal and Cuban history; thus, preparing themselves to solve problems in their lives, interpret their current situation, and carry out transformative, responsible, and voluntary actions by understanding time-space relationships. (4) Students are expected to adopt a healthy lifestyle; have a responsible sexuality based on gender equality; show love, compassion, respect, and responsibility in their relationships; reject any form of discrimination and dependency based on race, ethnic minorities, or gender; and understand the role of women in historical processes, their lifestyles, and consumption habits. (5) Students are encouraged to demonstrate emotion, sensitivity, creativity and originality in their interactions with their environment; to enjoy art and other cultural manifestations in various fields of local, national, Caribbean, Latin American and universal culture; appreciate the beauty of the attitudes, feelings, words and actions of masses and historical personalities; develop traditions and identity; care for universal and national cultural heritage; and in this process, form the basis of their social behaviour in line with the values of society and their individual characteristics. (6) Based on the role that labour has played throughout history as the primary source of human material and spiritual existence, students are expected to develop moral qualities such as responsibility, diligence, honesty, and solidarity; and to embrace the culture of work, technology, and economics by actively relating their learning processes to work. (7) Students are expected to demonstrate a holistic sense of responsibility and critical thinking regarding the protection of nature, the sustainability of life and the environment, and the preservation of natural and historical heritage. In this process, they are expected to comply with legal rules, understand the interdependencies among the economic, social, and ecological dimensions of sustainable development at the local, national, and global levels, within the framework of history and historical awareness, and act consciously in line with this understanding. (8) Students are expected to develop their ability to use various communication languages (verbal, physical, visual-auditory and algorithmic); to develop skills that will enable them to interact in different socio-cultural contexts by working on different types of historical sources and historical knowledge; and to use this process as a means of expressing their values, feelings, preferences, motivations, and interests.

The general objectives of the curriculum are oriented toward cultivating a comprehensive conception of citizenship grounded in national identity, revolutionary consciousness, and socialist values. Within this framework, students are expected to respect national heroes, revolutionary leaders, and state symbols; to demonstrate patriotic, anti-imperialist, and pro–Latin American attitudes; and to develop informed judgments about historical and contemporary events. The curriculum also seeks to regulate individual behaviour in accordance with social norms and collective goals, promote the rejection of discrimination, violence, and corruption, and foster the internalisation of egalitarian value systems. Core objectives include the development of a scientific worldview, an understanding of the historical and social role of labour, the internalisation of moral qualities such as responsibility, solidarity, and diligence, and the integration of learning with productive activities. In addition, the curriculum emphasises healthy living, gender equality, environmental sustainability, respect for cultural heritage, and the development of multi-communication competencies as essential dimensions of civic and personal development. Overall, the curriculum can be interpreted as aiming to educate

students as socially responsible and transformative citizens endowed with collective consciousness and critical thinking skills, while simultaneously positioning them within the ideological parameters of socialist citizenship. Thus, although the curriculum incorporates elements associated with critical inquiry and social transformation, these elements are embedded within a prescriptive ideological framework that delineates the boundaries of acceptable civic subjectivity and political agency.

3.2.2. History Curriculum Content

In Cuba, history is taught at the basic secondary education level in Years 7, 8, and 9. The history curriculum is organised chronologically during the first two years, whereas the final year is devoted exclusively to Cuban history (ME, 2020, pp. 60–80). Table 2 presents the distribution of content and instructional hours.

Table 2 ***History curriculum content***

Grade Level	Contents	Lesson Hours
Year 7	Ancient and Medieval History	62 hours
Year 8	Modern and Contemporary History	93 hours
Year 9	Cuban History	155 hours

The Seventh Grade Ancient and Medieval History curriculum is designed to enable students to interpret selected historical events and processes within their causal, spatial, and temporal contexts and to comprehend the role of labour in human and societal development. Through the examination of historical trajectories, students are expected to conceptualise societal evolution, articulate historical developments, and cultivate affective dispositions of admiration and solidarity toward individuals and groups who resisted injustice and rejected oppression and exploitation. The curriculum also aims to develop students' understanding of cultural developments and their contributions to global cultural heritage, to critically evaluate the roles of social actors and historical-cultural figures, and to compare the structural characteristics of different societies. Within this framework, political and moral values such as unity, sovereignty, patriotism, solidarity, self-sacrifice, and resistance to injustice are explicitly embedded as curricular outcomes. José Martí's La Edad de Oro and other normative historical texts are positioned as epistemic and moral reference points, indicating the integration of disciplinary knowledge with the transmission of ideological values (ME, 2020, pp. 60–64).

The Eighth Grade Modern and Contemporary History curriculum aims to foster students' understanding of selected events, phenomena, and processes of the Modern and Contemporary periods within causal, temporal, and spatial analytical frameworks, with a particular emphasis on American history. The curriculum aims to develop students' understanding of the Modern and Contemporary periods and to evaluate the historical impacts of capitalist development, particularly the socio-economic contradictions between the working class and the bourgeoisie, between metropoles and colonies, and among capitalist states. Students are encouraged to critically examine capitalism's systemic limitations in addressing global socio-economic inequalities and to analyse the deepening disparities between developed and developing countries. Moreover, the curriculum explicitly promotes the continued relevance of Marxist-Leninist theoretical perspectives in interpreting historical transformations and in articulating visions of a just society. Histories of Latin America, the Caribbean, Africa, and Asia are prioritised, with a strong emphasis on anti-colonial struggles, revolutionary movements, and social transformations. Revolutionary figures such as José

Martí, Ernesto Che Guevara, and Fidel Castro are incorporated as ideological and historical anchors, reflecting the curriculum's normative and directive ideological orientation (ME, 2020, pp. 65–73).

The Ninth Grade Cuban History curriculum aims to develop students' comprehensive historical understanding of Cuba's political, economic, social, and cultural development while explicitly supporting their political and ideological formation. The curriculum seeks to strengthen students' loyalty to the Revolution and its leaders, cultivate resistance to capitalism and imperialism, and reinforce commitments to national sovereignty and independence. Moral and civic dispositions such as humility, honesty, diligence, perseverance, critical thinking, and self-sacrifice are articulated as curricular objectives, aligning individual moral development with collective socialist ideals. Students are expected to engage with historical, political, legal, literary, geographical, and artistic sources; analyse Cuban literary texts; and develop aesthetic appreciation through engagement with cultural artefacts, including music, visual arts, architecture, and cinema. The curriculum further emphasises contextualising historical events within spatial and temporal frameworks, linking national and local histories, and engaging with the ideological and intellectual legacies of José Martí and Fidel Castro. Overall, the curriculum reflects a strongly normative and ideologically embedded approach in which disciplinary knowledge, values education, and political socialisation are systematically intertwined (ME, 2020, pp. 73–80).

When the content of the seventh-, eighth-, and ninth-grade history curricula is examined collectively, it becomes evident that the curriculum structures historical knowledge within an integrated ideological, moral, and cultural framework. In the Ancient and Medieval History curriculum, themes such as the evolution of human societies, the role of labour, struggles for justice, and resistance to oppression are emphasised, thereby constructing a value-oriented historical narrative through cultural heritage, collective actors, and historical figures. In the Modern and Contemporary History curriculum, critiques of capitalism, class struggle, anti-imperialism, the independence processes of Third World countries, and the historical legitimacy of socialist thought constitute a central axis of content. These thematic emphases position history education as a space for interpreting global socio-economic inequalities and power relations, while simultaneously embedding socialist perspectives within the curriculum framework. The Cuban History curriculum aims to foster students' commitment to the Revolution and its leadership by integrating national historical narratives with themes of revolutionary struggle, sovereignty, independence, and anti-imperialism. Historical figures such as Fidel Castro, Ernesto Che Guevara, José Martí, Camilo Cienfuegos, Vilma Espín, and Celia Sánchez are presented not only as sources of historical knowledge but also as moral and political role models, and students are encouraged to internalise these figures as reference points for their own attitudes and behaviours.

Within this context, history is utilised as a moral and ideological educational instrument, with values such as justice, solidarity, sacrifice, dedication, and revolutionary commitment positioned at the core of the curriculum. Moreover, the curriculum links historical knowledge to a sense of civic and political responsibility that supports the continuity of the socialist state and the revolutionary project. Students are expected to develop an ideological identity that situates them as carriers and sustainers of the Revolution by connecting historical examples of struggle and heroism with contemporary social duties and responsibilities. From a curriculum theory perspective, the curriculum content is designed not merely as a descriptive transmission of historical facts but as a normative curriculum that constructs a particular value system, collective identity, and political consciousness aligned with socialist ideology.

3.3. Citizenship Education Curriculum

3.3.1. General Objectives of the Citizenship Education Curriculum

The general objectives of the citizenship education curriculum are expressed in the curriculum as follows (ME, 2020, pp. 139–140): (1) To show admiration and respect for revolutionary heroes, martyrs, leaders, and prominent figures; national symbols and qualities. (2) To comply with the rules and objectives established in the context of family, school, and society by self-regulating; to reject all forms of discrimination and violence, to know and defend constitutional rights and duties, the Cuban legal system and its relations, and to take pride in the human ideals and values it upholds. (3) To demonstrate responsible and value-oriented behaviour based on moral, political, and legal content; use different sources of information, textbooks, and information and communication technologies as learning tools to develop general culture. (4) To understand basic information about the Cuban political system and its democratic character, evaluating global issues and the development challenges of Cuban society in relation to current events. (5) To explain the importance of adolescents adopting a healthy, happy, and balanced lifestyle; embracing sexuality based on gender equality, avoiding harmful substances, and adopting regular sports activities that will develop basic physical and sporting skills. (6) To express feelings, sensitivity, and emotions in the relationship between nature and humans; to enrich general culture by drawing on the most distinctive identity values of universal, national, and local culture; to value the preservation of heritage and aesthetic-artistic activities (literature, music, painting, architecture); to understand lifestyles in different periods and social strata. (7) To understand the importance of knowing and applying legal, moral, and etiquette rules, complying with these rules in relations with nature and society as a responsible citizen, supporting sustainable development in line with social and current needs in Cuba. (8) To demonstrate effective and emotional communication skills in daily life; use listening, speaking, reading, and writing creatively; show interest in reading different types of texts and develop aesthetic taste. (9) To show love, interest, dedication, and responsibility for the work they do; to evaluate the importance of the work in terms of its functioning in society, their own future life project, and the problems of today's world.

The Citizenship Education curriculum is designed to cultivate students' capacity to conceptualise social issues as matters of personal and collective concern and to enable them to participate effectively in addressing these issues with an awareness of their rights and responsibilities. Within this framework, the education system positions citizenship education as a foundational curriculum area that guides civic participation and shapes students' understandings of citizenship and civic agency. The curriculum functions as a normative framework grounded in moral and legal principles that regulate social coexistence and collective life. The curriculum's explicit emphasis on admiration and respect for revolutionary heroes, political leaders, and national symbols suggests that historical memory and national identity are constructed through a revolutionary narrative, and that civic consciousness is defined within this ideological framework. Students are expected to interpret national identity through historical struggles and shared collective values. Anchored in socialist moral principles, collective interests, social solidarity, and egalitarianism, the curriculum aims to position students as socially responsible subjects who recognize their accountability for the welfare and transformation of society as a whole.

3.3.2. Content of the Citizenship Education Curriculum

The Citizenship Education Course is taught in the 7th, 8th, and 9th grades of secondary level. There are two learning areas at each grade level (ME, 2020, pp. 140–146). Table 3 presents the distribution of content and instructional hours.

Table 3 ***Content of the Citizenship Education Course Curriculum***

Grade Level	Themes	Lesson Hours
7th Grade	Civic Education: Historical background and the formation of civic consciousness. Important Periods in the History of the Cuban Constitution: The Constitution of the Socialist Republic of Cuba.	46 hours
Year 8	Human Rights and Socialist Law Family and Society: The participation of Cuban youth in the construction of today's Cuban society.	46 hours
9th Grade	The Cuban Political System and Citizen Participation Cuban Youth's Responsibilities for the Future	31 hours

The Year 7 Citizenship Education curriculum is structured to cultivate students' civic consciousness through historical, ethical, and legal foundations. The curriculum initially traces the historical development of citizenship education in Cuba, introducing core concepts such as citizen, citizenship, and identity, and presenting the revolutionary conception of citizenship alongside the model of the ideal citizen in contemporary Cuban society. Ethical and moral values are conveyed through the exemplary moral qualities attributed to historical and revolutionary figures such as Che Guevara, Fidel Castro, Camilo Cienfuegos, Antonio Maceo, Celia Sánchez, and Vilma Espín, as well as through the writings of José Martí. The curriculum also addresses behavioural norms expected in social and school life, the meaning of national symbols, and respect for public property, thereby linking civic identity with everyday social practices. A substantial component of the curriculum is devoted to the Cuban Constitution, including its historical evolution, fundamental rights and freedoms, the principle of equality, provisions concerning education, science, and culture, and civic duties. Through these thematic strands, the curriculum seeks to strengthen students' ethical dispositions, civic awareness, and participatory orientation by reinforcing both individual and collective responsibility within the socialist social order (ME, 2020, pp. 141–142).

The Year 8 Citizenship Education curriculum adopts a holistic framework to enable students to understand human rights, the socialist legal system, family structures, and their social positioning in society. The curriculum begins with an examination of the historical development and contemporary significance of human rights, highlighting international human rights instruments, particularly the Convention on the Rights of the Child. It further explains how human rights are institutionalised within Cuba's socialist legal framework, including legal mechanisms that protect children and adolescents, as well as the roles of judicial institutions and prosecutors in safeguarding legality and justice. Within this context, the relationship between ideological struggle, the right to peace, and human rights is explicitly presented for critical reflection. A second thematic strand focuses on family and society. The family is conceptualised as the fundamental unit of society, and its characteristics and legal protection are examined. Adolescents' roles and responsibilities within the family, preparation for future family life, and challenges in family relationships are addressed. Topics such as love, friendship, respect, and sexuality are discussed within a pedagogical framework, with particular emphasis on the risks associated with early marriage and early motherhood. Finally, the curriculum emphasises adolescents' participation in social life, including their roles within neighbourhood and school contexts and their contributions to societal development. Overall, the curriculum aims to cultivate students as conscious civic subjects who are aware of their rights and responsibilities and

positioned as active participants in the reproduction and transformation of socialist society (ME, 2020, pp. 143–144).

The Year 9 Citizenship Education curriculum provides a comprehensive framework designed to enhance students' understanding of Cuba's political system, civic participation mechanisms, and contemporary global issues affecting young people. The curriculum begins with a review of prior knowledge and then focuses on the Cuban political system. In this context, the structure, functioning, and components of the political system—framed as one of the Revolution's fundamental achievements—are introduced. The curriculum explicates the role of the Cuban Communist Party (PCC) as the leading force in society, the functions of political, social, and mass organisations, and the socialist configuration of the state. It further addresses the concept of socialist democracy, Cuba's electoral system (Law 127), mechanisms for popular participation in decision-making processes, and adolescents' social roles in key domains such as education, labour, and national defence. The second thematic strand emphasises adolescents' individual responsibilities for the future and their awareness of contemporary global challenges. Topics such as responsible behaviour in everyday life, global inequalities in the twenty-first century, poverty, the impacts of the COVID-19 pandemic, and the significance of access to education and culture for development are examined. Environmental issues—including pollution, resource depletion, and their consequences for humanity—are discussed, with environmental consciousness framed within Cuba's National Curriculum for Adaptation to Climate Change (Tarea Vida). Finally, the curriculum addresses social risks faced by youth in capitalist societies, including racism, gender discrimination, xenophobia, child abuse, drug addiction, and violence, and explores potential solutions and alternative approaches. Overall, the curriculum aims to cultivate students as conscious and responsible civic actors who are critically aware of global issues and prepared to participate actively in their societies (ME, 2020, pp. 144–146).

An examination of the Citizenship Education curriculum reveals a fundamental ideological orientation toward constructing a model citizen committed to the Revolution and loyal to socialist values. The Ethical Code of the Revolution (El Código ético de la Revolución) and the presentation of figures such as Fidel Castro, Che Guevara, Antonio Maceo, and Vilma Espín as exemplary role models are intended to facilitate the internalisation of this historical and ideological trajectory among students. These individuals are positioned not merely as historical leaders but as moral exemplars embodying revolutionary virtues. Consequently, students are encouraged to adopt revolutionary ethics and to integrate values such as sacrifice, courage, solidarity, anti-imperialism, and collective responsibility into their everyday practices. Throughout the curriculum, the achievements of the Revolution and the legitimacy and preservation of the socialist system are consistently framed as civic duties. Citizenship is conceptualised as a collective identity aligned with the defence of the state, society, and the revolutionary order, rather than as a liberal framework centred on individual rights. Socialist citizenship is associated with prioritising the public good over individual interests, respecting social property, being productive, and perceiving work and learning as responsibilities undertaken in the service of the Revolution.

4. Discussion

The findings of this study indicate that the Geography, History, and Citizenship Education curricula in Cuba are not merely pedagogical texts focused on cognitive learning outcomes but rather provide a framework for systematically constructing a conception of citizenship aligned with socialist ideology. When the goals, content, and pedagogical orientations of these curricula are considered collectively, it becomes evident that they seek not only to equip students with historical knowledge, geographical

awareness, and citizenship competencies but also to foster a national identity grounded in patriotism, anti-imperialist consciousness, and socialist values. In this respect, the curricula of subjects equivalent to social studies in Cuba align with Safran's (2015) assertion that social studies serve not only to transmit knowledge but also to cultivate values, attitudes, and social consciousness.

When interpreted through Ross's (2024) framework of curriculum ideologies, Cuban curricula can be understood as functioning to legitimize and reproduce a particular ideological worldview. According to Ross, curricula are not neutral systems of knowledge; rather, they carry explicit or implicit ideological assumptions regarding what knowledge is valued, what type of citizenship is considered "ideal," and which social order is deemed legitimate. In the Cuban context, these assumptions materialize in revolutionary historical narratives, collective responsibility, labour-centred values, and anti-imperialism. Within this framework, historical and social content functions less as a site of critical pluralism and more as an instrument for constructing consciousness within the ideological parameters of socialism.

A second major finding concerns the way citizenship education is embedded within subject curricula rather than treated as a separate civic domain. The Geography and History curricula integrate values such as solidarity, collective responsibility, and international cooperation alongside disciplinary knowledge. In this sense, citizenship education appears not only as a formal subject but also as a broader pedagogical orientation across the curriculum. Similar patterns have been identified in other national contexts where citizenship education is closely linked to national political traditions and historical experiences (Arthur & Davies, 2017; Hahn, 2017). However, the Cuban curriculum differs from many Western models in that the ideological dimension of citizenship formation is articulated more explicitly in curriculum objectives and thematic content. Comparative education literature further demonstrates that citizenship education curricula are closely intertwined with political regimes, historical trajectories, and dominant ideological orientations (Arthur, Davies, & Hahn, 2017; Bray, Adamson, & Mason, 2007).

For instance, in socialist regimes, curricula tend to be structured to reinforce collectivism, class consciousness, and state-centred conceptions of citizenship, whereas in democratic regimes, pluralism, critical thinking, and human rights discourses are prioritized. In Scandinavian countries, social studies curricula are organized around deliberative democracy, participatory citizenship, and social justice, with pedagogical approaches designed to encourage students' critical and active engagement in political decision-making processes (Børhaug, 2017). In contrast, in liberal democratic countries such as the United States and the United Kingdom, curricula emphasize individual freedoms, constitutional order, and market-oriented conceptions of citizenship, while simultaneously reproducing certain hegemonic narratives through national history discourses (Arthur & Davies, 2017; Hahn, 2017; Apple, 2019; Yiğit, 2023). In Germany, social studies curricula are structured around confronting the totalitarian past and fostering commitment to constitutional democracy, with the concept of defensive democracy (wehrhafte Demokratie) occupying a central position (Arthur et al., 2017; Kaya, 2023). In France, secularism, republicanism, and a unitary national identity constitute the primary reference framework for citizenship education, with citizenship defined within a universalist, assimilationist republican paradigm (Arthur et al., 2017; Önal, 2023). In Japan, social studies curricula are shaped by emphases on national identity, social cohesion, and cultural continuity, with modernization processes legitimized through national narratives (Tunç-Şahin, 2023). In Canada and Australia, social studies curricula have been restructured to highlight multiculturalism, reconciliation, and the historical experiences of Indigenous peoples, reflecting the

influence of postcolonial critical perspectives on curriculum reform (Arthur et al., 2017; Öztürk & Deveci, 2021).

By contrast, in China, citizenship education is structured around socialist ideology, collectivism, and party loyalty; critical pluralism remains limited, and education is positioned as a strategic instrument for constructing socialist citizen identity (Kennedy, 2017). Tanrısevdi and Kıral (2018) similarly note that the Chinese education system aims to cultivate individuals in accordance with Marxism, Leninism, and Mao Zedong Thought, seeking to produce ideologically informed citizens committed to collective values. Likewise, Saklan (2016) emphasizes that the Vietnamese education system is structured within an ideological framework grounded in Marxist-Leninist and Ho Chi Minh thought, with education conceptualized as part of a broader project to build an egalitarian social order. In theocratic or religiously oriented regimes, curriculum frameworks are closely intertwined with religious ideology. In the Islamic Republic of Iran, social studies and history curricula are structured around Islamic values, revolutionary ideology, and loyalty to religious authority, with citizenship defined along a religious-national axis (Mehrmohammadi, 2014). Similarly, in Saudi Arabia and some Gulf countries, social studies and moral education curricula are organized around Sharia-based values, religious obedience, and collective identity formation, prioritizing the transmission of values over critical pluralism (Doumato & Starrett, 2007).

Another important finding relates to how global economic relations are interpreted within the curriculum. The geography curriculum presents multinational corporations as actors that contribute to the reproduction of economic inequalities between developed capitalist countries and Third World nations. This framing reflects a critical interpretation of globalisation that differs from the more neutral or market-oriented perspectives commonly found in many contemporary geography curricula. Similar observations have been made in studies examining curriculum ideologies, which suggest that curricular narratives about global economic processes often reflect broader political and economic perspectives embedded within national education systems (Apple, 2019).

Finally, the distribution of instructional time across grade levels also reveals important ideological priorities within the curriculum. The analysis indicates that greater emphasis is placed on modern and contemporary historical processes, particularly those related to the development of capitalism, revolutionary movements, and international political conflicts. This distribution suggests that the curriculum seeks to provide students with a historical framework for understanding contemporary global inequalities and political struggles. In this respect, the Cuban curriculum reflects a broader educational approach in which historical knowledge is closely linked to the formation of political consciousness and civic identity.

Taken together, these comparative findings indicate that social studies curricula function not merely as pedagogical texts but as political and cultural instruments that institutionalize regime-specific conceptions of citizenship and social ideals. In this regard, Cuban curricula should not be understood as ideologically neutral pedagogical texts, but rather as mechanisms through which a particular social project and political worldview are reproduced through education. As Ross (2024) argues, dominant ideology profoundly shapes what is considered the purpose of education, the role of schools in society, the meaning of being a good teacher or student, assumptions about the nature of knowledge, and ways of interpreting the world. From a critical perspective, every ideological framework contains explicit and implicit beliefs, values, and virtues; legitimizes certain educational practices while marginalizing others; carries political potential; assigns differentiated roles to teachers and students; defines the nature and scope of access to knowledge; shapes the educational

climate; and determines what is considered “appropriate” content or process. In the Cuban case, this framework can be interpreted as functioning to legitimize and sustain socialist ideology.

In conclusion, the primary aim of social studies is to prepare young people with the knowledge, skills, and values necessary for active participation in society. However, what constitutes the “necessary” knowledge, skills, and values, and how effective citizenship is defined, varies across societies and even within the same society over time. In this respect, social studies curricula may reflect the characteristics of democratic, totalitarian, or socialist systems, depending on a country's political regime (Safran, 2015). Moreover, as Hahn (1998) notes, there is no single form of democracy and no single way to teach democracy. Political ideologies play a decisive role in shaping national curricula, as governments’ ideological perspectives directly influence educational policies, curriculum design, and resource allocation, leading to curricular changes and reforms. Furthermore, an educational model developed by one government may be considered of limited value or even irrelevant by subsequent governments with different political orientations (Soto, 2015). Accordingly, social studies curricula are not merely technical instructional plans; rather, they are shaped by ideological preferences, societal goals, and political power relations. Therefore, social studies constitute a critical field in which questions of not only “what to teach,” but also “why, how, and for whom to teach” must be systematically interrogated.

5. Conclusion

In Cuba, the curricula of Geography, History, and Citizenship Education are designed not merely to transmit disciplinary knowledge but to cultivate individuals who are grounded in socialist values, possess a sense of collective responsibility, and internalize an anti-imperialist and revolutionary conception of citizenship. This orientation should not be interpreted as an exceptional characteristic of socialist regimes; rather, it underscores that social studies, as a field, is not ideologically neutral globally. Instead, it inevitably reflects the dominant political, cultural, and socio-historical ideologies embedded within specific national contexts. From this perspective, the present study argues that social studies curricula should be conceptualized not only as pedagogical documents but also as ideological texts and sites of political discourse production.

As Noffke (2000) argues, the purpose of social studies education should not be to uncritically reproduce existing meaning-making structures that are grounded in cultural and economic inequalities and designed to sustain the status quo. Rather, social studies should contribute to the construction of alternative social orders grounded in democracy and economic justice. Such a social order should not be conceptualized as a fixed or final endpoint but as a dynamic, ongoing process continually negotiated and reconstructed through social practices. This perspective positions social studies not merely as an instrument for legitimizing existing social arrangements but as a potential space for critical citizenship education and transformative social change.

6. Declarations

6.1. Author Contributions (CRediT)

Study conception and design: Fisun Bozkurt; analysis and interpretation of results: Fisun Bozkurt; draft manuscript preparation: Beyza Kaygısız. The author(s) reviewed the results and approved the final version of the article.

6.2. Conflict of Interest

The authors declare no financial, commercial, or personal conflicts of interest related to this study.

6.3. Funding Statement

The author declares that the study received no funding.

6.4. Data Availability Statement

The curriculum documents analysed in this study are publicly available on the official website of the Cuban Ministry of Education.

6.5. Ethics Approval

This study is based entirely on document analysis and does not involve human participants, personal data collection, or any experimental intervention. Therefore, ethics committee approval was not required for this research.

6.6. Use of Artificial Intelligence (AI) Tools

In this study, GPT-4 (OpenAI) was employed only for language correction, writing support, and formatting. All data collection, analysis, and interpretation were conducted and validated entirely by the author(s). Any AI-generated content was reviewed for scientific accuracy, ethical compliance, and source reliability by the author(s), who assume full responsibility.

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Emotion regulation of preservice teachers: Integrating emotional dimensions into online education

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ABSTRACT

In this study, preservice teachers' activating and deactivating emotions and emotion regulation strategies in online education were investigated. With this purpose in mind, two related studies were conducted. In Phase 1, the preservice teachers' activating and deactivating emotions in an online setting were investigated. In Phase 2, emotion regulation strategies of preservice teachers in online education were examined. While the first phase used quantitative methods, the second one employed qualitative methods. According to results, the most frequently mentioned emotions among preservice teachers in online education are positive emotions such as enjoyment, peacefulness, hopefulness, and happiness. It has been observed that attention shifting and avoidance were used to regulate their emotions. Preservice teachers' emotions were positive, though they had problems utilizing diverse emotion regulation strategies.

KEYWORDS: Preservice teachers; Emotion regulation; Online education

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1. Introduction

The transition to online teacher education during the pandemic has created a new landscape for preservice teachers (PTs), eliciting complex emotions amid the unique challenges of online education (Zembylas, 2005). As students, PTs faced critical challenges in online learning environments, including unreliable internet access, limited peer interaction, poor connectivity, and high data costs (Bunyamin et al., 2021). Moreover, low motivation, demands on self-regulation, cognitive overload, delayed feedback, limited social learning, and unstable study spaces pose additional challenges for students (Draxler-Weber et al., 2022; Fabito et al., 2020; Khalaf & Al Athali, 2020; Makarova, 2021). Thus, emotion regulation—monitoring, evaluation, and modification of emotional responses—has become an essential skill for PTs as they strive to navigate digital classrooms and sustain their professional development (Gross, 1998; Schutz & Zembylas, 2009).

The challenges PTs face in online education have been extensively studied; however, the psychological mechanisms they use to overcome these challenges remain underexplored. Emotion regulation, the attempt to alter emotions in ourselves/others, has emerged as an important competency that sustains professional development in the digital learning environment. To understand those mechanisms, this study is grounded in Gross's Process Model of Emotion Regulation (Gross, 1998). The model emphasizes that emotion regulation does not occur in a one-

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time manner but rather as a process unfolding over the timeline of emotion generation. The model differentiates between “antecedent-focused strategies”, such as situation selection, attentional deployment, and cognitive change that occur before the creation of an emotional response, and “response-focused strategies” in the form of response modulation or suppression that occur after the emotion is felt (Aldao et al., 2010). Research generally suggests that antecedent strategies are adaptive and linked to well-being, with cognitive reappraisal being a particularly important one (Gross & John, 2003), whereas response-focused suppression is usually maladaptive and associated with burnout (John & Gross, 2004). The specific ways in which an online learning environment constrains preservice teachers' selection of these strategies, however, remain unclear.

The need to investigate those strategies stems from the close relationship between emotions and the formation of a teacher identity. While learning to teach in face-to-face education, PTs navigate a complex emotional landscape, encountering intense and diverse feelings during their initial teaching experiences (Cohen & Roman, 2020). Emotions can hinder identity formation, whereas positive experiences may promote its reconstruction (Teng, 2017), indicating a connection between the emotional journey and PTs' professional identity formation. Becoming a teacher involves what Bloomfield (2010) describes as a “struggle for voice,” encompassing background, emotion, and institutional structures, which highlights the multifaceted and comprehensive nature of teacher identity development. To describe their emotional experiences, PTs’ metaphors illustrate how they conceptualize emotions as burdens, tools, and sources of self-knowledge (Muñoz-Salinas, 2025). However, many PTs report inadequate emotional support or opportunities to process their complex emotional journeys (Cohen & Roman, 2020). The crucial role in shaping professional identity places significant responsibility on teacher education programs, which must acknowledge and address the emotional dimensions of becoming a teacher (Muñoz-Salinas, 2025; Teng, 2017).

In light of the complex emotions associated with online education, research indicates that PTs experience both positive and negative emotions during online teaching and learning, which in turn influence their professional identity formation (Astutik & Hapsari, 2022; Syakira et al., 2023). These emotions evolve as they adapt to the digital environment, shifting from anxiety and frustration to delight and determination (Syakira et al., 2023). In this context, emotional resilience is just as essential as strong communication skills for successfully navigating the new educational landscape (Astutik & Hapsari, 2022). PTs’ emotional reactions to online learning activities were revealed via tools such as emotion diaries and blogs, uncovering a wide range of emotional states that may influence their educational experiences (Mills & Ritchie, 2014). While higher education can support students’ emotion regulation skills and enhance their motivation to learn, it could lead to deeper engagement and academic achievement (Xu et al., 2024). On the other hand, students also commonly experience negative emotions such as self-doubt and alienation, which often align with their self-perceptions (Bharuthram, 2018). Therefore, it is critical to address emotional factors in preservice teacher education to foster effective learning environments and cultivate emotionally resilient future teachers.

Teachers’ emotions are commonly categorized into two broad types: activating and deactivating emotions (Frenzel, 2014). Positively activating emotions, such as enjoyment, enthusiasm, and pride, are associated with increased engagement and motivation and with effective classroom management. However, negatively activating emotions, such as anger, may contribute to adverse teacher responses (Taxer & Frenzel, 2015). Deactivating emotions, such as sadness, anxiety, and helplessness, are linked to reduced energy, lower classroom engagement, and poorer instructional decision-making (Chang, 2009). These emotions are frequently associated with professional burnout

and diminished motivation (Sutton & Wheatley, 2003). Given the importance of teacher emotions, research highlights the necessity of emotion regulation and the ability to meaningfully interpret emotional experiences as key components of professional growth (Fried et al., 2015).

Understanding the emotional experiences and regulation strategies used by PTs during online education is essential, as emotions significantly influence learning, engagement, and identity formation (Astutik & Hapsari, 2022; Teng, 2017). The transition to online teaching presents unique emotional challenges and opportunities that can affect students' motivation, involvement, and well-being (Chang, 2009; Xu et al., 2024). Isenbarger and Zembylas (2006) define teachers as emotional workers, and changing circumstances forced them to shift educational activities online, creating a new dimension of teachers' emotional regulation. Although the significance of teacher emotions for educational quality is recognized, a substantial gap remains in the literature on the regulative potential of these emotions in online learning environments. The literature has provided comprehensive, descriptive explanations by identifying teachers' emotional conditions (e.g., anxiety or joy), but has not examined the regulation of emotional experience. Furthermore, a lack of specificity has been identified in applying the Gross model to explain the antecedents of online teacher education for PTs. To address this gap, this study employed a mixed-methods approach to provide a comprehensive analysis and understanding of PT's emotional regulation within an online education system. Thus, the current study aims to investigate the emotions and emotion regulation strategies (ERS) experienced by PTs during their online education. For this aim, the following research questions were formulated: (1) How intensely do the preservice teachers during their online education feel emotions (positive activating, positive deactivating, negative activating, and negative deactivating ones)? (2) How do preservice teachers regulate their emotions in online education?

2. Emotion Regulation of Preservice Teachers

Emotion regulation was defined by Gross (1998) as "the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (p. 275). It is considered a central component of psychological functioning and mental health (Aldao et al., 2010). The extended process model of emotion regulation conceptualizes regulation strategies along the timeline of emotional generation. The model outlines five strategies: situation selection, situation modification, attentional deployment, cognitive change, and response modulation (Gross, 1998). Situation selection involves approaching or avoiding certain situations based on their anticipated emotional consequences. Situation modification involves altering the environment to alter its emotional impact. Attentional deployment includes shifting attention toward or away from emotional aspects of a situation. Cognitive change entails reinterpreting the meaning of a situation to alter its emotional significance. Response modulation occurs after the emotional response has been triggered and focuses on managing the experiential, behavioral, or physiological aspects of emotion. Among these, cognitive reappraisal is generally regarded as an adaptive strategy associated with long-term emotional well-being. At the same time, expressive suppression is often considered maladaptive due to its link with psychological distress (Aldao et al., 2010). Cognitive reappraisal is linked to greater positive affect and effective psychological adjustment (Gross & John, 2003), whereas expressive suppression is associated with higher stress and decreased well-being (John & Gross, 2004).

The PTs experience a wide range of emotions and commonly use ERS, such as instant messaging, social media, and face-to-face communication, to manage them (Wetcho & Na-Songkhla, 2022). To support emotion regulation among PTs, the literature suggests implementing evidence-based strategies that promote positive emotions and foster coping mechanisms (Iovino et al., 2021). It is

also crucial to consider the multidimensional nature of well-being when designing educational environments. For instance, Blake and Dewaele (2023) recommend incorporating agency, empathy, and reflection to mitigate the negative impacts of stress on teacher well-being. ERS serve as mechanisms for individuals to monitor, evaluate, and modify emotional reactions to achieve personal or contextual goals (Gross, 1998). These strategies are generally divided into antecedent-focused and response-focused categories. Antecedent-focused strategies modify the interpretation of an emotion-eliciting situation before the emotional response entirely unfolds, leading to more adaptive outcomes (Gross & John, 2003). In contrast, response-focused strategies involve inhibiting the outward expression of emotions after they have been activated and are associated with negative psychological consequences, including heightened stress and impaired interpersonal functioning (John & Gross, 2004). In online education, emotion regulation is critical for managing stress, maintaining instructional quality, and creating positive learning environments (Chang, 2009). Teachers' capacity for emotional regulation not only contributes to their professional identity development but also shapes how they engage with students and instructional practices (Zembylas, 2005).

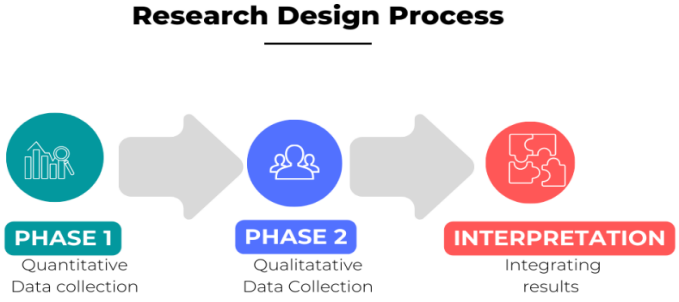
3. Study Context

In Türkiye, preservice teacher education (PTE) underwent significant changes after the pandemic lockdown. At the policy level, higher education institutions decided to offer at least 30% of their courses online to prepare students for the requirements of the century (HEI, 2022). After this decision, the courses in PTE have been offered in face-to-face, hybrid, and fully online formats. In the literature, teachers' emotions have a critical role in the effectiveness of the teaching and learning process (Chen, 2021). In light of this dramatic change in PTE, online education has gained attention in recent years.

4. Method

This research was designed as an explanatory mixed-methods study (Creswell & Clark, 2017), comprising two sequential phases that examined preservice teachers' emotions and emotion regulation strategies in online education. The first phase was conducted to reveal the current state of their emotions, while the second phase explored how they regulate those emotions in online education. Educational opportunities and online teaching experiences shape preservice teachers' attitudes toward online education (Getenet et al., 2024; Zhang & Zhu, 2025). Considering this, the first aim was to identify which emotions preservice teachers experienced during online education using a larger sample. Then, in light of the findings, their emotion regulation strategies were examined in depth through interviews with a small sample of preservice teachers. The research process is shown in Figure 1.

Figure 1 ***Research Design Process***



4.1. Phase 1

This phase employed a descriptive research design to explore the emotions experienced during online education while participants developed themselves as future online teachers. Quantitative research was employed to capture PTs' emotions, facilitating an in-depth exploration of participants' current situations.

4.1.1. Participants

The participants of this phase were enrolled in various teacher education programs within a faculty of education in Türkiye. 127 PTs (91 women and 36 men) from different teacher education programs were included in the study and enrolled in various departments. The participants' ages ranged from 19 to 41 (M = 20.66, SD = 3.10), providing a broad perspective on the development of online teacher identity across various stages of teacher education. All participants were enrolled in at least one online course as students (M = 49.95, SD = 23.10).

4.1.2. Material

An online emotion-recording and reflection form, developed by researchers, was used to collect data. According to the two experts' views, the initial version of the form was revised for face and content validity. It was then piloted with 12 PTs, and based on their reflections, the form was finalized. The reason for choosing an online form was to make participants feel free to explore their emotions. PTs answered closed-ended questions in which they examined negative activating emotions (stress, anxiety, shyness, and fear); negative deactivating emotions (sadness, confusion, restlessness, hopelessness, and feeling unqualified); positive activating emotions (happiness, success, sociability, willingness, delight, energy, feeling qualified, and hopefulness); and positive deactivating emotions (surprise, peace, calmness, and security). The closed-ended questions required rating the intensity of these emotions experienced in online education on a five-point scale ranging from 1 (lowest) to 5 (highest). Those emotions were selected considering the relevant literature on human emotions (Ekman, 1992; Izard, 1977). Open-ended questions were about explaining their emotional experiences in online education. See Table 2 for sample questions.

Table 2 ***Sample Questions***

Emotion	1 (Lowest)	2	3	4	5 (Highest)	Open-ended question
Stress						The reason why you feel stressed

Data were collected during the spring semester of 2025, after obtaining ethical committee approval. PTs participated in the study voluntarily and completed the informed consent form after being informed about the study objectives, anonymity and confidentiality, data collection tools and procedures, and before the data collection phase. The form link was distributed via their institutional email; participants were asked to complete the form within a week to reflect on the questions and answer them in detail.

4.2. Phase 2

This phase employed a basic qualitative research design to explore ERS among PTs in online education. Qualitative research was used to provide an in-depth understanding of the phenomenon, enabling extensive exploration of participants' perspectives on emotion regulation. Qualitative research provides a portrayal of human experience and the meanings humans construct within their contexts. The method also enhances the reality of participants' voices, providing a rich, detailed analysis of their experiences in online educational environments.

4.2.1. Participants

The sample comprised 41 undergraduate students, including 10 males and 31 females, who were randomly selected from Phase 1 participants. The participants' ages ranged from 20 to 25 years (M = 21.12, SD = 1.18). All participants voluntarily took part in the study and provided informed consent before data collection.

4.2.2. Data Collection and Procedure

The interview schedule was developed by considering Gross's model and its dimensions with demographic questions. The questions concerned explanations of how the emotions participants reported in Phase 1 were regulated during online education. Sample interview questions include: "During the online education process, did you make any choices to avoid environments in which you felt emotionally distressed, or to prefer situations where you felt more comfortable? Could you describe an example of such a choice?" and "Have you ever attempted to modify or leave an online learning environment that had a negative impact on you? Could you describe an example?" The interviews, which lasted approximately 20 minutes, were conducted to ensure anonymity and confidentiality during the spring semester of 2025. The researchers, experienced in conducting interviews, led the data collection process. To achieve data saturation, researchers continued interviewing until participants' responses became repetitive.

4.2.3. Data Analysis

Both qualitative and quantitative data analysis methods were employed to examine PTs' emotional experiences and their ERS. PTs' ratings for each emotion were analysed to assess the distribution and intensity of emotions among them by using descriptive statistics (e.g., means and standard deviations). The emotions were analysed by grouping them according to control-value theory (Pekrun, 2006) categories: positive and negative activating and deactivating emotions. PTs' emotion regulation strategies during online education were reviewed and coded to identify potential themes rooted in Gross's Extended Process Model of Emotion Regulation (Gross, 2015). For this purpose, a content analysis framework was employed to analyze data via deductive category development "to elucidate explicit definitions, reference examples, and coding rules for each deductive category, thus helping to determine the exact criteria by which parts of the data (e.g., text passages) will be coded" (Gläser-Zikuda et al., 2020, p. 4).

Data have been read and reread to ensure familiarity, and codes have been allocated to classify the reasons behind emotional experiences and ERS in online education. Initial codes were revealed by researchers in the first turn of the coding process. In the second turn, researchers recoded the entire dataset, considering both concurrent and emerging codes. Once the code list was determined, the codes were categorized according to Gross's Model. To ensure validity, several methods were used, including triangulation, member checking, thick description, and expert review. Data from both qualitative and quantitative sources were used for triangulation. As part of the audit trail, participants were asked to review and confirm their responses and analysis results to ensure the accuracy of the interpretations (Creswell & Poth, 2016). Also, as suggested by Lincoln and Guba (1985), direct quotations from participants were represented. Moreover, the interview form was developed by the researchers and reviewed by experts in teacher education, psychological counselling, and guidance to ensure content validity. To ensure research reliability, inter-coder agreement, consistency in data collection, and pilot testing were used. Two independent researchers coded the data, and discrepancies between their codes were discussed until consensus was reached (Miles, 1994). Cohen's kappa coefficient was calculated as .85, reflecting high reliability.

5. Findings

5.1. Results of Quantitative Data Analysis on Emotion in Online Education

PTs' emotions were analyzed by grouping activating and deactivating positive and negative emotions following the control-value theory (Pekrun, 2006). Table 3 shows the positive emotions; among them, happiness (M = 4.66, SD = 0.62) and delightfulness (M = 4.62, SD = 0.71) are common. PTs' positive deactivating emotions have diverse mean scores. The most frequently felt positive deactivating emotion is peacefulness (M = 4.65, SD = 0.75), while the least frequently felt is calm (M = 3.90, SD = 1.86).

Table 3 ***Positive Emotions (Activating & Deactivating) of Preservice Teachers in Online Education***

Emotion	Type	M	SD
Happiness	Activating Positive	4.661	0.62
Delightfulness	Activating Positive	4.630	0.71
Hopeful	Activating Positive	4.587	0.82
Successful	Activating Positive	4.575	0.72
Volunteer	Activating Positive	4.570	0.82
Sociable	Activating Positive	4.551	0.76
Energetic	Activating Positive	4.433	0.87
Qualified	Activating Positive	4.394	0.80
Surprised	Activating Positive	2.200	1.13
Peaceful	Deactivating Positive	4.653	0.76
Secure	Deactivating Positive	4.630	0.72
Calm	Deactivating Positive	3.898	1.86

Table 4 shows PTs' negative emotions in online education. This indicates that PTs feel negative deactivating emotions less than positive ones. Among the negative deactivating ones, confusion (M = 1.90, SD = 1.03) is reported more frequently, and hopelessness (M = 1.19, SD = 0.66) is reported less frequently. Among those, stress (M = 1.70, SD = 0.94) and anxiety (M = 1.70, SD = 0.91) are the most common emotions. On the other hand, unqualified (M = 1.21, SD = 0.70) and sorry (M = 1.31, SD = 0.64) are felt less than other deactivating negative emotions.

Table 4 ***Negative Emotions (Activating & Deactivating) of Preservice Teachers in Online Education***

Emotion	Type	M	SD
Stressed	Activating Negative	1.698	0.95
Anxious	Activating Negative	1.698	0.91

Emotion	Type	M	SD
Confused	Activating Negative	1.896	1.03
Fear	Activating Negative	1.246	0.65
Shy	Activating Negative	1.294	0.72
Sorry	Deactivating Negative	1.302	0.64
Hopeless	Deactivating Negative	1.192	0.67
Unqualified	Deactivating Negative	1.309	0.70
Peaceless	Deactivating Negative	1.294	0.73

The findings revealed that PTs predominantly experienced high levels of both activating and deactivating positive emotions. The mean scores for these emotions ranged from 4.39 to 4.66, with relatively low standard deviations, indicating a consistent pattern across participants. In contrast, negative emotions were reported at considerably lower levels. Activating negative emotions yielded moderate mean scores (ranging from 1.24 to 1.90). Negative emotions were reported to be deactivated, with the lowest mean values, suggesting they were not commonly experienced among participants.

5.2. Results of Qualitative Data Analysis on Emotion Regulation Strategies

PTs' emotion regulation strategies were analyzed using Gross's (1998) model. Participants' physical regulation strategies were categorized as avoidance, self-regulation, and environmental regulation (see Table 5). The most frequent one is avoidance, such as engaging in unrelated activities, sleeping, resting, and postponing tasks. As self-regulation strategies, participants preferred removing distractors, changing physical location, and wearing comfortable clothing to enhance concentration and comfort. Environmental regulation strategies focused on the study environment, such as establishing a dedicated workspace or modifying a classroom's physical layout.

Table 5 ***Codes for Physical Regulation Strategies with Supporting Quotations***

Sub-theme	Code	f	Example Quotation
Self-regulation	Removing distractions	1	"I turned off my phone to focus better."
	Changing the room	4	"When I couldn't concentrate, I moved to another room."
	Wearing comfortable clothes	2	"I put on my comfy hoodie to feel more relaxed."
Environmental regulation	Organizing the desk	1	"I cleaned my desk before starting to study."
	Arranging classroom layout	1	"I rearrange the classroom in a way that makes me easily focus."
	Creating a study setup	1	"I made a small study corner in my room."
Avoidance	Taking breaks	2	"I just stepped away for a few minutes."

Sub-theme	Code	f	Example Quotation
	Engaging in unrelated activities	18	"I started watching random videos instead of studying."
	Sleeping	11	"I went to sleep hoping I'd feel better after."
	Resting while lying down	7	"I lay down and tried to relax."
	Avoiding the task	9	"I kept postponing the assignment."
	Ignoring the challenges	1	"I acted like it wasn't a big deal."

PTs apply situation modification strategies to alter external circumstances to meet their academic needs in online education. Technical alterations, alternative solutions to connection problems, and changing devices are frequently used. Additionally, situational adjustments were made by changing rooms or waiting for a quieter time to study. This finding suggests that technological competence and adaptability play a key role in students' ability to maintain continuity in their academic tasks, especially in online or hybrid learning contexts. Some participants reported unsuccessful attempts as failed regulatory behaviors (see Table 6). These strategies reflect a proactive attempt to manage distractors and optimize concentration (Boekaerts & Corno, 2005; Zimmerman, 2002).

Table 6 ***Codes for Situation Modification Strategies with Supporting Quotations***

Sub-theme	Code	f	Example Quotation
Technical Alterations	Seeking alternative solutions for connection problems	17	"I switched to mobile data when the Wi-Fi didn't work."
	Changing the device	8	"I used my tablet instead when my laptop froze."
	Getting homework help online	1	"I searched for examples on YouTube to understand better."
Situational Alterations	Changing the environment	14	"I changed the room to get away from the noisy environment."
	Preferring a quieter place	6	"I waited until everyone went to sleep to study in silence."
	Organizing the study space	4	"I rearranged my desk to feel more motivated."
Unsuccessful Attempts	Ineffective or failed regulation attempts	4	"I tried changing places, but it didn't really help."

Participants reported digital distractions, alternative engagements, physical activities, and self-soothing and regulation as ways to divert their attention from stress-inducing academic tasks. The most frequently preferred strategy for attention deployment is digital distractions: spending time on the phone, browsing social media, and watching videos. Furthermore, students frequently used other activities to avoid them, such as engaging in other activities, rearranging their study area, or looking outside. Physical activities such as wandering around and walking outdoors were also mentioned; however, they were less frequent. Several participants notably discussed self-soothing and regulation techniques, such as sipping herbal tea, talking to oneself, breathing techniques, and becoming more aware of their bodies.

Table 7 ***Codes for Attentional Deployment Strategies with Supporting Quotations***

Sub-theme	Code	f	Example Quotation
Digital Distractions	Spending time on the phone	11	"I just kept checking my phone instead of studying."
	Browsing social media	6	"I scrolled through Instagram to clear my mind."
	Watching videos	2	"I watched short videos to distract myself."
Alternative Engagements	Engaging in other tasks	17	"I started doing chores to avoid studying."
	Reading a book	1	"I read a chapter of a novel to take my mind off things."
	Playing games	1	"I played a mobile game to relax."
	Taking a break	1	"I gave myself a short break to breathe."
	Looking outside	2	"I look through the window for a while."
	Rearranging study space	4	"I reorganized my desk to feel more focused."
	Sleeping	1	"I took a nap to reset my mind."
Physical Activities	Walking outdoors	1	"I went for a quick walk outside."
	Wandering around	1	"I just walked aimlessly to clear my head."
Self-soothing & Regulation	Drinking herbal tea	1	"I made myself some herbal tea to calm down."
	Self-talk	1	"I told myself I could handle it."
	Breathing exercises	1	"I focused on my breathing to relax."
	Body awareness	1	"I paid attention to how tense my body felt and tried to release it."

Table 8 presents the cognitive reappraisal strategies participants used to cope with challenges, with a focus on individual-centered approaches and the advantages of online learning. As individual-centered strategies, goal orientation, self-empowering thoughts, cognitive reframing (especially in response to external stressors such as the earthquake), and expressing personal opinions were commonly employed behaviors. One notable strategy was to develop empathy toward instructors, demonstrating the emotional and mental effort to understand the challenges educators might be facing. The advantages of online education for participants included reflection on cognitive reappraisal of the online learning environment. Commonly cited advantages included the flexibility of time and location independence, suggesting that students valued the freedom and autonomy of online education. Moreover, easy access to content, comfort, easier exams, cost-effectiveness, and the development of digital skills were framed as benefits that reduced academic stress and enhanced learning.

Table 8 *Codes for Cognitive Reappraisal Strategies with Supporting Quotations*

Sub-theme	Code	f	Example Quotation
Individual-Centered	Goal orientation / self-empowering thoughts	1	"I reminded myself why I started and focused on my long-term goals."
	Cognitive reframing	3	"I consciously shifted to a calmer mindset to facilitate my ability to focus."
	Expressing individual opinions	1	"I felt more comfortable expressing my views during online classes."
	Developing empathy toward the instructor	1	"I thought the teacher might also be struggling, so I tried to understand."
Getting the Advantages of Online Education	Repeated access to content	3	"I could rewatch the lessons whenever I needed to understand better."
	Time flexibility	12	"It was easier to manage my schedule and avoid stress."
	Independence from location	12	"I didn't have to worry about commuting or being in a specific place."
	Easier exams	2	"The exams felt less stressful compared to face-to-face ones."
	Cost-effectiveness	3	"I saved money because I did not travel and eat out."
	Comfort	2	"Being at home made learning more comfortable and stress-free."
	Gaining digital skills	1	"I learned how to use new platforms and tools."
	No absenteeism issues	1	"Even when I was unwell, I could still attend classes from home."

Participants expressed varying perceptions of how different learning modalities influenced their ability to regulate emotions during online education. The majority reported feeling more comfortable and emotionally expressive in face-to-face settings. Some found emotion regulation to be easier in online environments, citing greater personal control over their emotional state. A few participants indicated that face-to-face contexts revealed feelings of anxiety and tension. Only two participants reported no significant difference between the two modalities regarding emotional regulation.

Table 9 *Perceptions of Emotion Regulation in Face-to-Face vs. Online Learning Contexts*

Code	f	Example Quotation
Feeling more comfortable face-to-face	20	"I feel more natural and expressive in face-to-face settings."
No difference between modalities	2	"It doesn't matter whether it's online or in person for me."
Emotion regulation is easier online	15	"Online classes give me more control over my emotional state."
Feeling challenged in face-to-face settings	4	"In face-to-face settings, I feel more anxious and tense."

The integration of results from the quantitative and qualitative phases reveals a complex interplay between preservice teachers' emotional experiences and their regulatory behaviors. Although the results of Phase 1 showed a prevalence of positive activating emotions, suggesting high levels of motivation and flexibility, the results of Phase 2 showed a strong reliance on avoidance-based regulation strategies, such as digital distraction and sleep, to cope with stress. This finding indicates that although the flexibility of online education contributes to positive affect, it can inadvertently promote maladaptive regulation strategies by enabling students to disengage easily from academic tasks rather than proactively regulating themselves or cognitively reappraising the situation. Consequently, the high rates of positive emotions observed during the quantitative phase may also, to some extent, reflect temporary comfort afforded by avoidance behaviors during the qualitative phase, rather than actual regulatory competence. This is also in line with the finding that while students appreciate the autonomy of online learning, they lack the metacognitive skills to use this autonomy to structure the learning environment or to set effective goals. Thus, the findings collectively point to the importance of the gap between positive emotions in digital learning and actual emotion regulation, which teacher education programs need to address in order to transform passive avoidance into antecedent-focused resilience.

6. Discussion

PTs report notably different emotional experiences in traditional face-to-face and online learning contexts due to limited emotional and social interaction between students and teachers (Sepúlveda-Escobar & Morrison, 2020). In Phase 1, PTs' positive emotions may reflect emotional readiness and psychological preparedness for the teaching profession in online education. On the other hand, the notable variability in certain negative emotions—such as confusion—may reflect the need for individualized support and differentiated guidance throughout the teacher training process. Regan et al. (2012) highlight the emotions of instructors in online learning environments, including feelings of restriction, stress, devaluation, validation, and rejuvenation. Emotional labor of PTs in an online setting may yield both positive (e.g., increased confidence) and negative outcomes (e.g., burnout). In this study, PTs exhibited more positive activating and deactivating emotions than negative ones in online education.

Various reasons can explain this. Firstly, PTs' high motivation towards professional development may be related to these positive emotions (Timoštšuk & Ugaste, 2010). Another reason may be that, as preservice teachers, the freedom and greater comfort afforded by the student role in online education may appeal to them. Similarly, they may perceive the opportunities for environmental and social support in online education as attractive (Kebritchi et al., 2017). Along with all these, studies show that the adaptation and compatibility with technology of the Z and alpha generations, which constitute the sample of this study, are higher (Ziatdinov & Cilliers, 2021).

In Phase 2, the findings indicate that PTs employed a range of physical regulation strategies to manage academic stress during online education—often to regain control over their emotional states and learning environments. The results of the study align with prior research indicating that avoidance strategies in online education, such as ignoring tasks, are associated with stress and lower engagement (Mozid, 2022). Notably, avoidance strategies were used more frequently than self-regulation or environmental regulation techniques. While some participants adopted proactive behaviors (e.g., changing rooms, organizing study spaces) to enhance concentration, many resorted to passive or avoidance behaviors, such as watching unrelated videos, sleeping, or engaging in irrelevant tasks. This pattern suggests a limited repertoire of adaptive coping strategies among some PTs, particularly under conditions of academic pressure. In line with the findings of the current study,

Kohnke et al. (2021) indicated that the opportunity to create a suitable location and the sharing of problems with classmates are self-regulatory learning strategies. The frequent use of avoidance-based strategies is consistent with previous studies indicating that such behaviors offer short-term relief but may compromise long-term academic performance and emotional well-being (Boekaerts, 2011). Moreover, the relatively low usage of environmental regulation strategies may indicate a lack of awareness or limited access to structural modifications that could support effective self-regulation.

The findings on attentional deployment further reveal a strong reliance on avoidance-based behaviors, particularly digital distractions and alternative tasks. This tendency may reflect the difficulty many students face in sustaining attention and managing emotions, especially in online or self-directed learning environments. The frequent use of mobile devices, time spent on social media, and non-academic tasks (e.g., household chores) suggest a preference for immediate emotional relief over intentional self-regulation. Although some participants reported using self-soothing techniques (e.g., breathing exercises, self-talk), these appeared infrequent and possibly underdeveloped. This supports earlier findings that, in the absence of explicit instruction, students are more likely to adopt passive or externally driven strategies than active, internal ones. These patterns highlight the need for interventions that enhance metacognitive awareness and emotional regulation (Veenman, 2016) to help PTs not only manage their own stress but also model adaptive regulation in their future classrooms.

Environmental adjustments to regulate emotions during online education, such as changing rooms, adjusting lighting, reducing noise, and organizing the work area, can help manage stress and enhance emotional control (Kohnke et al., 2021). People who change their work environment to reduce distractions experience lower levels of emotional exhaustion. In addition, digital environmental regulations, such as turning off notifications or website blockers, can also be effective (Zimmerman, 2002). The study reveals how participants engaged in both individual cognitive efforts and contextual evaluations to regulate their emotions and sustain motivation during an unprecedented learning period. This aligns with the capacity to select and implement the most contextually appropriate strategy (Bonanno & Burton, 2013). This study highlights the role of time flexibility and location independence in online education for emotional regulation. It is stated that the opportunity to manage the learning environment in accordance with personal rhythms and emotional states can reduce stress and enhance self-regulatory capacities (Martin & Bolliger, 2018). According to Jääskelä et al. (2017), learners who can control the timing and pace of their learning report greater emotional independence and engagement. In addition, the asynchronous structure of many online learning environments, as noted in this study's results, makes it easier for individuals to re-evaluate challenging content emotionally (Gross, 2015). It has been stated that flexibility in the online learning environment supports a balance between students' academic demands and other life responsibilities and can act as a buffer against emotional burnout (Hart, 2012).

PTs in this study had difficulty managing emotional challenges, particularly in online learning contexts, stemming from technological difficulties, delayed feedback, feelings of isolation, and performance-related anxiety. The ability to regulate such emotions effectively is not only vital for their personal well-being but also essential for fostering teaching efficacy and creating emotionally supportive learning environments (Sutton & Wheatley, 2003). In online education, where emotional and social support are limited, PTs used self-calming strategies infrequently—despite their importance in reducing isolation and stress (Kebritchi et al., 2017). Practices such as mindfulness, breaks, and music help reduce anxiety and improve focus (Maddock & Blair, 2023). Emotion

regulation is vital for teachers' well-being and effectiveness, especially given the limited interpersonal interaction online (Gross, 1998). Suppression leads to burnout and disengagement (Gross & John, 2003), while reappraisal supports commitment and mental health (Aldao et al., 2010). The emotional demands of online teaching can strain authenticity (Zembylas, 2005), making regulation skills essential for managing burnout and self-efficacy (Yang & Du, 2024). Mindfulness offers a promising alternative to traditional ERS in digital settings (Shang, 2024), helping PTs stay motivated, resilient, and emotionally engaged.

Research indicates that people with lower self-regulatory capacities use avoidance-based emotion regulation in online learning (Wang et al., 2024). On the other hand, those with high self-regulation appear to use learning outcomes more consciously by alleviating negative emotional states (Zhu et al., 2024). In light of these findings, it is essential to provide teachers with interventions that enhance both emotional awareness and functional regulation capacities. Mindfulness-based programs, emotion-tracking applications, and social-emotional learning modules tailored for educators may serve as promising tools in this regard (Chen, 2021). Breathing and mindfulness-based programs for PTs to develop self-calming strategies will help increase emotional well-being and maintain academic motivation in online education.

This research highlights PTs' emotions and their strategies for emotional regulation in online education. During online education, PTs frequently reported positive emotions, driven by motivation and flexible learning environments. On the other hand, they mainly apply avoidance-based ERS to cope with negative emotions such as stress. Limited use of self-calming and well-being practices requires comprehensive teacher education focused on emotional regulation strategies. Therefore, self-regulation modules can be considered essential components of teacher education programs for preparing PTs for online teaching by providing opportunities to support their well-being, academic performance, and ability to model healthy ERS in their profession. Considering the results of this study, emotion regulation skills in digital contexts should be supported by the curricula for future teachers. Online teaching competencies and emotionally responsive skills of PTs should be strengthened in their education process.

This study has some limitations. The study concentrates on emotion regulation in online education. However, online education was widespread during the pandemic and after the earthquake in Türkiye. Those unexpected situations evoked different emotions and led to insufficient preparation, which may constitute a limitation. Moreover, future research can examine emotion regulation strategies, access to technology, institutional support, course design, and evolving educational contexts. The data for this study were collected over a single time period, which limits its ability to reveal change over time. Longitudinal studies could give insights into how preservice teachers' emotion regulation strategies evolve over time.

7. Declarations

7.1. Author Contributions (CRediT)

Author 1 (Dr. Gökçe Sancak-Aydın): Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization.

Author 2 (Dr. Hatice Cılsalar-Sagnak): Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization.

7.2. Conflict of Interest

The authors declare that they have no known competing financial interests, institutional affiliations, or personal relationships that could have appeared to influence the work reported in this paper.

7.3. Funding Statement

This research received no external funding.

7.4. Data Availability Statement

Data are available from the corresponding author upon reasonable request, subject to participant confidentiality agreements.

7.5. Ethics Approval

Ethical approval for this study was granted by the Yozgat Bozok University Social and Humanities Sciences Ethical Committee (Approval No: 08/27; Approval Date: 23.11.2023). All participants signed a consent form prior to data collection.

7.6. Use of Artificial Intelligence (AI) Tools

The authors disclose the use of AI-assisted tools in the preparation of this manuscript as follows: language editing. AI tools were not used to generate or alter empirical data, produce analytical results, or shape the core findings and conclusions of the study. All AI outputs were reviewed and verified by the authors, who take full responsibility for the integrity, originality, and accuracy of the content.

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Examination of curriculum literacy and pedagogical knowledge and skill levels of secondary school teachers

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ABSTRACT

The study aims to examine the relationship between secondary school teachers' perceptions of curriculum literacy and their pedagogical knowledge and skill levels. The study was designed using relational research, a quantitative research method. The study participants comprised 221 secondary school teachers working in Ordu province. When the study results were examined, it was determined that middle school teachers' curriculum literacy levels were above the average on the scale. Among the sub-dimensions of curriculum literacy, secondary school teachers had the highest level of perceived valuing of the curriculum and the lowest level of questioning it. Also, teachers' pedagogical knowledge and skill levels are generally above the midpoint of the scale. Among the pedagogical knowledge and skills sub-dimensions, teachers had the highest mean score in the student learning sub-dimension and the lowest in the instructional support sub-dimension. In the study, it was also determined that there was no significant difference between secondary school teachers' curriculum literacy levels and pedagogical knowledge and skills levels according to the variables of subject area and professional seniority. According to the research results, a significant positive relationship was found between secondary school teachers' curriculum literacy levels and their pedagogical knowledge and skills.

KEYWORDS: Curriculum literacy; Pedagogical knowledge and skills; Teachers' professional development

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1. Introduction

Teachers are one of the most fundamental elements of the education system. The success of the curriculum is directly related to how the teacher interprets, implements, and evaluates the curriculum. Innovations in curriculum require teachers to be not only curriculum implementers, but also critical thinkers and guides who can direct and encourage active student participation. These innovations require teachers to continuously evaluate and develop their pedagogical knowledge and skills, as well as their level of understanding of the curriculum. The curriculum guides the education and teaching processes. The curriculum determines the objectives of education, the content needed to achieve them, how to convey this content to students, and how to assess students' achievement of these objectives (Çetinkaya & Tabak, 2019). The curriculum is the resource that guides teachers in the education and teaching process. For this reason, teachers must have knowledge and competence in the content, subject matter, skills, and all elements aligned with the curriculum's

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objectives (Posner, 1995). Because teachers organize their content and lessons within the framework of educational programs, they must understand the curriculum and implement it effectively for the curriculum to be effective. Effective curriculum implementation is possible only if teachers can interpret the curriculum well and clearly understand its components.

This area of professional knowledge, defined as curriculum literacy, was first defined by Shulman (1987) as "curriculum knowledge." Shulman (1987) defined the concept of curriculum knowledge as the teacher's awareness of all components of the curriculum planned for teaching their own subject or a specific area, knowledge of the variety of materials included in the curriculum, and the ability to use these materials appropriately for their students. Ariav (1988), on the other hand, considers the concept of "curriculum literacy" as an extension of curriculum knowledge; he expresses it as a pedagogical competence area ranging from a teacher's conscious analysis and selection of ready-made materials (basic level) to understanding the dynamics of more comprehensive curriculum development processes (advanced level). In the context of Turkey, the concept of curriculum literacy is defined by Keskin and Korkmaz (2017, p. 858) as "the ability to be knowledgeable about educational programs, interpret them, evaluate them with a critical eye, and adapt them to life conditions." MoNE (2017) lists the skills teachers need to be good curricular literates as: knowing the basic philosophical approach of the curriculum, being able to explain how learning takes place according to psychological theories, considering the compatibility between the program and the cultural and social environment in which it is implemented, relating the outcomes to basic and field-specific skills, and being able to prepare teaching methods and techniques to be used in the learning-teaching process in line with the outcomes in the curriculum, as well as assessment and evaluation techniques and lesson plans suitable for student characteristics.

Curriculum literacy has been addressed by researchers in different dimensions. Research conducted on this topic is presented in Table 1 (Aslan & Gürlen, 2019; Bolat, 2017; Erdamar, 2020; Kahramanoğlu, 2019; Keskin, 2019; Yar Yıldırım, 2018).

Table 1 ***Research on the dimensions of curriculum literacy***

Research	The dimension of curriculum literacy
Aslan & Gürlen, 2019	Curriculum knowledge, planning, implementation
Bolat, 2017	Goal, content, learning and teaching processes, assessment and evaluation
Erdamar, 2020	Teachers' knowledge of the curriculum and their ability to implement it
Kahramanoğlu, 2019	The foundations, elements, and structural characteristics of the curriculum
Keskin, 2019	Understanding the curriculum, implementing the curriculum, evaluating the curriculum, valuing the curriculum
Yar Yıldırım, 2018	Curriculum knowledge (purpose, philosophy, concepts), skills (curriculum preparation, implementation, guidance, monitoring, evaluation, management skills), and attitudes (assistance, support, meeting needs, explanation)

The study is based on Keskin's (2019) classification of the components of curriculum literacy mentioned above. The understanding the curriculum dimension is interpreted as knowing the factors included in the curriculum, such as the number of learning outcomes, the distribution of learning outcomes, and the duration of implementation. In other words, this dimension is defined as the

process of understanding the curriculum's content and structure. One of the most emphasized issues regarding curricula is that teachers must have sufficient knowledge about them. Erden (1998) states that the variables aimed at increasing student achievement are classroom and out-of-classroom activities carried out within the framework of the curriculum; he emphasizes that it is important for teachers to first understand the curriculum in order to plan and design these activities. The most important and comprehensive dimension of curriculum literacy, the implementation of the curriculum dimension, is defined as planning, interpreting, and adapting, from an interdisciplinary perspective, personal differences, determining materials, gains, and content (Keskin, 2019). In other words, the implementation of the curriculum dimension refers to the application of the curriculum in the classroom or real-world learning environments. The curriculum inquiry dimension is considered a process of critically examining the curriculum. Teachers who are proficient in curriculum literacy can take a more critical approach in their comments and evaluations of the curriculum. In this way, teachers' creativity develops, and the quality of learning environments can improve (Keskin, 2019). The dimension of valuing the curriculum contributes to curriculum development by reflecting on its role in education. This perspective, which can be summarized as teachers' acceptance of the curriculum, is based on the need for teachers to adopt a positive approach to the curriculum to better adapt it (Keskin, 2019).

The meaning of curriculum literacy can be expressed as knowing, recognizing, applying, and planning the implemented curriculum. For this reason, a curriculum-literate teacher is expected to analyze the curriculum thoroughly and apply it effectively to their students, thereby benefiting them (Güleş, 2022). In this context, the better the teacher's knowledge and skills, the more students' learning and the continuity of what they learn will increase proportionally (Karacaoğlu, 2008). In this regard, teachers should not only be content with knowledge and skills related to their own fields but also possess pedagogical knowledge and skills. Shulman (1986) was the first to emphasize that teachers must possess pedagogical content knowledge in addition to their subject-specific knowledge and professional knowledge. Shulman (1986) categorized the knowledge teachers should possess into instructional content knowledge, subject-specific knowledge, and pedagogical content knowledge, and defined pedagogical content knowledge as the knowledge of presenting and explaining topics that are continuously taught in a specific field in a way that is understandable to others, using the most useful expressions, examples, analogies, and definitions. Pedagogical knowledge is the ability to facilitate the learning of easy or difficult information for students of different ages and classes (Shulman, 1986). Shulman argues that teachers must possess knowledge of a subject area to explain it in ways students can understand, and that each teacher can convey the subject in different ways (Shulman, 1987).

Shulman (1986) states that the basic components of pedagogical content knowledge are the elements that represent the subject, demonstration knowledge, and understanding of students' learning difficulties. He emphasizes that teachers need to know that these components are interconnected and flexible. According to Shulman (1987), the fundamental types of knowledge that constitute teachers' expertise are classified as follows: (1) Subject Knowledge: Knowledge of the concepts and principles that constitute the subject area; (2) Curriculum Knowledge: Knowledge of the materials and curriculum required for the teacher; (3) Pedagogical Content Knowledge: The combination of content and pedagogy within the teacher's area of expertise; (4) General Pedagogical Knowledge: All knowledge related to subject knowledge and classroom organization and management; (5) Knowledge of students and student characteristics; (6) Knowledge of classroom environments; (7) Knowledge of the goals, values, and expected outcomes to be achieved in the

educational process. Pedagogical content knowledge is addressed in four dimensions: “Subject content knowledge,” “Knowledge of understanding students,” “Knowledge of teaching strategies,” and “Knowledge of curriculum” (Grossman, 1990; Shulman, 1987). Pedagogical content knowledge encompasses educators’ knowledge of how to teach a specific subject to a group of students, using multiple teaching strategies, presentation methods, and interpretation methods, while working within the cultural, social, and contextual constraints of the learning environment (Park & Oliver, 2008). Teachers who are proficient in pedagogical knowledge and skills prevent their students from learning incorrectly or incompletely through their instructional strategies and techniques, enable them to learn information that is considered difficult, raise their academic achievement, and help them reach their expected goals (Shulman, 1986).

In Turkey, the Ministry of National Education (MoNE) began work on teacher competencies in 1999 and established a “Teacher Competencies Commission” involving various stakeholders. The commission defined teacher competencies in three areas: “general cultural knowledge and skills,” “teaching and learning competencies,” and “subject-specific knowledge and skills,” which were implemented in 2002. Due to evolving conditions and shifts in the knowledge teachers need, the Ministry of National Education (MoNE) defined the “General Competencies for the Teaching Profession” framework in 2017. These competencies encompass the skills, attitudes, and knowledge that teachers need. The general competency areas of the teaching profession consist of professional skills, professional knowledge, attitudes, and values (MoNE, 2017). According to Gökçek and Yılmaz (2019), pedagogical knowledge and skills constitute a multidimensional structure that forms teacher competence. Pedagogical knowledge and skills encompass a multifaceted structure that includes content knowledge, pedagogical content knowledge, and general pedagogical knowledge, as well as skills such as interpretation, perception, and decision-making (König et al., 2015). Within this multidimensional structure, teachers should not be content with merely knowing the content of the lesson or subject; they should also know how best to convey it in line with students' characteristics and manage the classroom. Pedagogical knowledge encompasses all interactions between students and teachers. Teachers with a high level of pedagogical knowledge and skills can prevent students from learning incorrectly or incompletely by using effective teaching strategies and techniques, ensure that topics considered difficult to learn are easily understood, and thereby improve their academic achievement (Shulman, 1986).

A review of the literature reveals studies examining teachers’ curriculum literacy levels. These studies were generally conducted with different sample groups and different variables. Most of the studies have addressed teachers’ curriculum literacy competencies and dimensions (Aslan, 2018; Berberoğlu, 2024; Çetinkaya & Tabak, 2019; Durak, 2024; Gürbüz, 2021; Keskin, 2019; Tanaş, 2023). Most of the studies are research conducted to determine the curriculum literacy levels of teachers, teacher candidates, and administrators. The studies also developed scales to assess teachers’ curriculum literacy levels and identified the dimensions of curriculum literacy through their findings (Aslan, 2018; Bolat, 2017; Erdamar, 2020; Kahramanoğlu, 2020; Keskin, 2019). Most studies on pedagogical knowledge and skills have been conducted with teacher candidates and physical education teachers (Doğangün, 2022; Işıkgöz et al., 2022; Penjiyev et al., 2024; Zümrütyaprak, 2024). There are a limited number of studies that examine curriculum literacy and pedagogical knowledge and skill levels together. Dilek (2020) examined the relationship between curriculum literacy and pedagogical knowledge and skills with 213 teacher candidates, while Dikmen (2023) examined the relationship between curriculum literacy, curriculum autonomy, and pedagogical knowledge and skill levels with 226 elementary and middle school teachers. A review of the literature reveals that few

studies have examined the relationship between middle school teachers' curriculum literacy levels and their pedagogical knowledge and skills in Turkey. Therefore, this study fills a gap in the literature. Beyond filling a gap in the literature, this study conceptualizes curriculum literacy not as an isolated skill but as a foundational component of the holistic structure of teachers' professional knowledge. As emphasized by Shulman (1987), curriculum knowledge and pedagogical skills are inextricably linked; the ability to decode and interpret the curriculum (literacy) facilitates the effective deployment of pedagogical strategies in the classroom.

The main objective of this study is to investigate whether there is a meaningful relationship between middle school teachers' curriculum literacy levels and their pedagogical knowledge and skill levels. In line with this main objective, the study sought answers to the following questions: (1) What is the level of middle school teachers' perceptions of curriculum literacy? (2) What is the level of middle school teachers' pedagogical knowledge and skills? (3) Do middle school teachers' perceptions of curriculum literacy vary according to their subject area and professional seniority? (4) Do middle school teachers' pedagogical knowledge and skill levels vary according to their subject area and professional seniority? (5) Is there a meaningful relationship between middle school teachers' levels of curriculum literacy and their pedagogical knowledge and skills?

2. Method

2.1. Research Design

To determine the relationship between middle school teachers' curriculum literacy and their pedagogical knowledge and skill levels, the study employed a correlational quantitative research design. Correlational studies aim to determine the existence and strength of relationships among two or more variables (Büyüköztürk et al., 2016). In the first and second sub-problems of the study, the curriculum literacy and pedagogical knowledge and skill levels of middle school teachers were determined; in addition, it was examined whether teachers' literacy levels and pedagogical knowledge and skill levels differed significantly according to the variables of professional seniority and branch. These sub-problems were conducted with a descriptive research design.

2.2. Participants and Procedure

The study population consists of middle school teachers actively working in public schools in Ordu province during the 2023–2024 academic year. When determining the sample from this study population, the number of teachers working in middle schools in the center of Ordu province was first obtained from the Ordu Provincial Directorate of National Education, and it was determined that 810 teachers were employed. Schools were selected from this study population using random sampling, and teachers working in these middle schools were included in the study. The number of teachers to be included in the study was determined by calculating the sample size using the tables developed by the Research Advisors (2006), which were developed using the sample size calculation formula by Krejcie and Morgan (1970, cited in Canbazoglu-Bilici, 2019). It was determined that 211 teachers needed to be reached within a 95% confidence interval for the research. Taking this into account, scale forms were distributed to 270 teachers in the study. However, teachers who did not want to participate in the study and those who provided incomplete or incorrect coding on the completed scales were excluded, and the study was conducted with 221 teachers. In the study, care was also taken to ensure that the sample included middle school teachers from as many subject areas as possible. The demographic characteristics of the teachers are presented in Table 2.

Table 2 ***Demographic characteristics of teachers***

Categories		N	%
Gender	Female	137	62
	Male	84	38
Professional Seniority	0–5 year	24	11
	6–10 year	52	24
	11–15 year	52	24
	16–20 year	38	16
	21 year and over	55	25
Subject areas	English	31	14
	Mathematics	30	13
	Religious Culture and Ethics	24	11
	Turkish	41	19
	Social Studies	27	7
	Science	23	10
	Other	45	5
Total		221	100

2.3. Data Collection Instruments

In the study, the "Personal Information Form" was used to collect personal information from the middle school teachers participating. The "Curriculum Literacy Perception Scale," developed by Keskin and Korkmaz (2021), was used to assess the curriculum literacy levels of middle school teachers. The "Pedagogical Knowledge and Skills Scale" developed by Gökçek and Yılmaz (2019) was also employed. The "Personal Information Form" was developed by the researchers to obtain information about the gender, professional seniority, type of school, and subject area of the participating teachers.

The "Curriculum Literacy Perception Scale" developed by Keskin and Korkmaz (2021) consists of 38 items and has a four-dimensional structure. These dimensions are named as follows: recognizing the program, questioning the program, implementing the program, and valuing the program. The scale is a five-point Likert type. The Cronbach's alpha for the measurements was .934. The "Pedagogical Knowledge and Skills Scale," developed by Gökçek and Yılmaz (2019), is a five-point Likert-type measurement tool comprising six sub-dimensions (Student Learning, Teaching Support, Lesson Planning, Adaptation to Diversity, Importance and Interest, and Classroom Management) and 37 items. The Cronbach's alpha internal consistency coefficients for the subdimensions of the scale range from 0.79 to 0.87, and the value for the entire scale is 0.94. Within the scope of the research,

Cronbach's alpha coefficients were calculated to assess the reliability of the measurement tools, and the results are presented in Table 3.

Table 3 ***Reliability levels of the measurement tools used in the study***

Measurements	Cronbach's alpha internal consistency coefficient
Understanding the curriculum	.969
Implementing the curriculum	.970
Questioning the curriculum	.972
Valuing the curriculum	.973
Curriculum Literacy Levels	.968
Student Learning	.970
Lesson Planning	.970
Teaching Support	.970
Adapting to Diversity	.969
Classroom Management	.971
Importance and Interest	.970
Pedagogical Knowledge and Skills	.968

Upon examining Table 3, it was determined that both measurement tools used as data collection instruments in the study had high reliability.

2.4. Data Analysis

Ethical approvals were first obtained from the XXXX University Education Research Ethics Committee. Subsequently, permission to conduct the research was obtained from the relevant Provincial Directorate of National Education. Throughout the data collection process, the scales were administered to middle school teachers at the schools identified for the study, and the purpose of the research was explained to them. Teachers participating in the application process were selected voluntarily, and no personal identifying information was requested from them. The scales were administered face-to-face and online. Data were collected between January 2024 and April 2024. The Jamovi 2.3.28 program was used to analyze the data obtained from the study. In the study's data analysis, the data were first examined for normality; accordingly, the kurtosis and skewness coefficients were calculated (Table 4).

Table 4 ***Data normality distribution analysis***

Measurements	Skewness	Kurtosis
Understanding the curriculum	−0.479	0.640
Implementing the curriculum	−0.508	1.77

Measurements	Skewness	Kurtosis
Questioning the curriculum	−1.32	3.40
Valuing the curriculum	−0.766	1.13
Curriculum Literacy Levels	−0.813	1.47
Student Learning	−1.000	2.44
Lesson Planning	−0.960	3.35
Teaching Support	−0.608	0.993
Adapting to Diversity	−0.521	0.393
Classroom Management	0.831	1.30
Importance and Interest	−1.040	2.49
Pedagogical Knowledge and Skills	−0.866	2.40

Table 4 shows that skewness values range from −1.32 to −0.479, while kurtosis values range from 0.393 to 3.40. According to Tabachnick and Fidell (2013), if skewness and kurtosis values are between −1.5 and +1.5, the data are approximately normally distributed. In this regard, the skewness and kurtosis values obtained in the study indicate a normal distribution. Within the scope of the study's first and second sub-problems, arithmetic means, and standard deviations were calculated to determine the literacy levels of middle school teachers' teaching programs and their pedagogical knowledge and skills. Within the scope of the study's third sub-problem, a one-way analysis of variance was conducted to examine whether middle school teachers' instructional program literacy levels and pedagogical knowledge and skill levels differed by the variables of professional seniority and branch. To determine whether the relationship between middle school teachers' curriculum literacy levels and their pedagogical knowledge and skill levels was significant, Pearson correlation coefficients were calculated for all subscales.

3. Findings

3.1. Middle School Teachers' Curriculum Literacy Perception Levels

The first problem of the study examined middle school teachers' levels of perceived curriculum literacy. The findings of the analysis are presented in Table 5.

Table 5 ***Middle school teachers' levels of curriculum literacy perception***

Scale sub-dimensions	N	X̄	SS
Understanding the curriculum	221	4.13	0.530
Implementing the curriculum	221	4.29	0.513
Questioning the curriculum	221	4.30	0.583
Valuing the curriculum	221	3.95	0.625
Curriculum Literacy Levels	221	4.18	0.502

Table 5 shows that the curriculum literacy levels of middle school teachers participating in the study were relatively above the midpoint of the scale. The lowest average score among the curriculum literacy subdimensions was in the "questioning the curriculum" dimension, while the highest was in the "valuing the curriculum" dimension.

3.2. Middle School Teachers' Levels of Pedagogical Knowledge and Skills

The second problem of the study examined the pedagogical knowledge and skill levels of middle school teachers. The results of the analysis are shown in Table 6.

Table 6 ***The pedagogical knowledge and skill levels of middle school teachers***

Scale sub-dimensions	N	X̄	SS
Student Learning	221	4.40	0.52
Lesson Planning	221	4.32	0.53
Teaching Support	221	4.27	0.53
Adapting to Diversity	221	4.32	0.54
Classroom Management	221	4.30	0.61
Importance and Interest	221	4.36	0.58
Pedagogical Knowledge and Skills	221	4.33	0.50

Table 6 shows that teachers' pedagogical knowledge and skill levels are generally above the midpoint of the scale. Among the sub-dimensions of middle school teachers' pedagogical knowledge and skill levels, the "student learning" dimension has the highest average score, whereas the "teaching support" dimension has the lowest.

3.3. Middle School Teachers' Curriculum Literacy Perception Levels According to Subject Area and Professional Seniority

The third sub-problem of the study examined whether middle school teachers' perceptions of curriculum literacy differed by subject area and professional seniority. In line with this research problem, a one-way ANOVA was conducted to determine whether middle school teachers' levels of curriculum literacy perception differed by subject area. The findings are presented in Table 7.

Table 7 ***An examination of middle school teachers' curriculum literacy perception levels according to subject area variable***

Scale sub-dimensions	Categories	N	X̄	ss	F	p
Understanding the curriculum	English	31	4.08	0.534	1.361	0.239
	Mathematics	24	3.92	0.530		
	Religious Culture and Ethics	30	4.12	0.457		
	Turkish	41	4.18	0.618		
	Social Studies	23	4.12	0.428		

Scale sub-dimensions	Categories	N	X̄	ss	F	p
	Science	27	4.10	0.480		
	Other	45	4.29	0.544		
Implementing the curriculum	English	31	4.32	0.600	0.666	0.678
	Mathematics	24	4.16	0.526		
	Religious Culture and Ethics	30	4.27	0.471		
	Turkish	41	4.30	0.542		
	Social Studies	23	4.26	0.433		
	Science	27	4.26	0.486		
	Other	45	4.41	0.509		
Valuing the curriculum	English	31	4.23	0.503	0.992	0.436
	Mathematics	24	4.16	0.593		
	Religious Culture and Ethics	30	4.22	0.597		
	Turkish	41	4.32	0.740		
	Social Studies	23	4.36	0.490		
	Science	27	4.33	0.576		
	Other	45	4.44	0.503		
Questioning the curriculum	English	31	3.84	0.515	1.655	0.142
	Mathematics	24	3.68	0.707		
	Religious Culture and Ethics	30	3.96	0.665		
	Turkish	41	4.02	0.724		
	Social Studies	23	3.99	0.452		
	Science	27	3.92	0.565		
	Other	45	4.15	0.603		
Curriculum Literacy Levels	English	31	4.14	0.489	1.165	0.332
	Mathematics	24	4.00	0.521		
	Religious Culture and Ethics	30	4.16	0.466		

Scale sub-dimensions	Categories	N	X̄	ss	F	p
	Turkish	41	4.21	0.599		
	Social Studies	23	4.18	0.348		
	Science	27	4.16	0.459		
	Other	45	4.33	0.508		

Table 7 shows that there is no significant difference between middle school teachers' curriculum literacy perception levels and the subject area variable ($p > .05$). The fact that teachers' curriculum literacy perception levels did not differ in relation to the subject area variable can be explained by the fact that the mean scores for curriculum literacy perception levels were close to each other across the scale and its subdimensions. To determine whether middle school teachers' perceptions of curriculum literacy differed significantly by professional seniority, a one-way ANOVA was conducted, and the results are presented in Table 8.

Table 8 ***An examination of middle school teachers' curriculum literacy perception levels according to the variable of professional seniority***

Scale sub-dimensions	Categories	N	X̄	ss	F	p	Statistically significant difference
Understanding the curriculum	0–5 year	24	4.14	0.389	1.783	0.139	–
	6–10 year	52	4.02	0.499			
	11–15 year	52	4.24	0.483			
	16–20 year	38	4.04	0.604			
	21 year and over	55	4.21	0.582			
Implementing the curriculum	0–5 year	24	4.33	0.342	2.617	0.040*	11–15 year and 16–20 year
	6–10 year	52	4.24	0.534			
	11–15 year	52	4.47	0.478			
	16–20 year	38	4.14	0.546			
	21 year and over	55	4.28	0.536			
Valuing the curriculum	0–5 year	24	4.49	0.437	2.304	0.064	–
	6–10 year	52	4.19	0.639			
	11–15 year	52	4.41	0.459			
	16–20 year	38	4.20	0.586			
	21 year and over	55	4.30	0.660			

Scale sub-dimensions	Categories	N	$\bar{X}$	ss	F	p	Statistically significant difference
Questioning the curriculum	0–5 year	24	4.13	0.453	1.179	0.139	–
	6–10 year	52	3.91	0.565			
	11–15 year	52	4.00	0.583			
	16–20 year	38	3.76	0.709			
	21 year and over	55	4.03	0.703			
Curriculum Literacy Levels	0–5 year	24	4.25	0.332	2.040	0.095	–
	6–10 year	52	4.10	0.502			
	11–15 year	52	4.30	0.435			
	16–20 year	38	4.05	0.565			
	21 year and over	55	4.22	0.555			

Table 8 shows that there is no statistically significant difference in middle school teachers' perceptions of curriculum literacy levels according to their professional seniority in terms of the subdimensions of recognizing the curriculum, valuing the curriculum, and questioning the curriculum, as well as in their overall curriculum literacy levels ($p > .05$). In addition, it was determined that there was a statistically significant difference in middle school teachers' curriculum literacy perception levels according to their professional seniority in the sub-context of implementing the curriculum ($F = 2.617$; $p < .05$). Looking at the results of the Games-Howell test conducted to determine the difference between the groups, the perception levels of teachers with 11 to 15 years of professional seniority regarding the implementation dimension of the curriculum show a significant difference compared to teachers with 16 to 20 years of professional seniority.

3.4. Middle School Teachers' Pedagogical Knowledge and Skill Levels According to Subject Area and Professional Seniority

In the fourth sub-problem of the study, it was examined whether middle school teachers' pedagogical knowledge and skill levels differed significantly across subject areas and levels of professional seniority. In line with this research problem, a one-way ANOVA was conducted to determine whether middle school teachers' pedagogical knowledge and skill levels differed significantly by subject area, and the findings are presented in Table 9.

Table 9 ***Examination of middle school teachers' pedagogical knowledge and skill levels according to subject area variable***

Scale sub-dimensions	Categories	N	$\bar{X}$	ss	F	p
Student Learning	English	31	4.31	0.525	0.669	0.675
	Mathematics	24	4.43	0.568		
	Religious Culture and Ethics	30	4.30	0.504		

Scale sub-dimensions	Categories	N	$\bar{X}$	ss	F	p
	Turkish	41	4.43	0.449		
	Social Studies	23	4.34	0.439		
	Science	27	4.41	0.393		
	Other	45	4.52	0.664		
Lesson Planning	English	31	4.23	0.526	0.841	0.542
	Mathematics	24	4.29	0.477		
	Religious Culture and Ethics	30	4.20	0.522		
	Turkish	41	4.38	0.569		
	Social Studies	23	4.30	0.480		
	Science	27	4.32	0.381		
	Other	45	4.47	0.641		
Teaching Support	English	31	4.28	0.528	0.456	0.839
	Mathematics	24	4.28	0.495		
	Religious Culture and Ethics	30	4.15	0.627		
	Turkish	41	4.27	0.548		
	Social Studies	23	4.27	0.517		
	Science	27	4.26	0.331		
	Other	45	4.39	0.611		
Adapting to Diversity	English	31	4.26	0.530	1.138	0.347
	Mathematics	24	4.23	0.577		
	Religious Culture and Ethics	30	4.24	0.534		
	Turkish	41	4.38	0.568		
	Social Studies	23	4.18	0.555		
	Science	27	4.37	0.418		
	Other	45	4.47	0.571		
Classroom Management	English	31	4.23	0.640	1.049	0.400
	Mathematics	24	4.16	0.654		

Scale sub-dimensions	Categories	N	X̄	ss	F	p
	Religious Culture and Ethics	30	4.23	0.623		
	Turkish	41	4.36	0.680		
	Social Studies	23	4.18	0.627		
	Science	27	4.41	0.428		
	Other	45	4.42	0.571		
Importance and Interest	English	31	4.32	0.568	1.049	0.400
	Mathematics	24	4.31	0.575		
	Religious Culture and Ethics	30	4.31	0.533		
	Turkish	41	4.39	0.635		
	Social Studies	23	4.19	0.595		
	Science	27	4.31	0.463		
	Other	45	4.54	0.633		
Pedagogical Knowledge and Skills	English	31	4.27	0.511	0.831	0.549
	Mathematics	24	4.29	0.495		
	Religious Culture and Ethics	30	4.24	0.475		
	Turkish	41	4.37	0.529		
	Social Studies	23	4.25	0.475		
	Science	27	4.35	0.311		
	Other	45	4.47	0.587		

Table 9 shows that middle school teachers' pedagogical knowledge and skill levels do not reveal any significant differences according to the subject area variable ($p > .05$). The fact that teachers' pedagogical knowledge and skill levels do not differ according to the subject area variable can be explained by the fact that the mean scores for pedagogical knowledge and skill levels are close to each other across the scale and its subdimensions. To determine whether there were any statistically significant differences in the pedagogical knowledge and skill levels of middle school teachers by professional seniority, a one-way ANOVA was conducted, and the results are presented in Table 10.

Table 10 ***Examination of middle school teachers' pedagogical knowledge and skill levels according to the variable of professional seniority***

Scale sub-dimensions	Categories	N	X̄	ss	F	p
Student Learning	0–5 year	24	4.43	0.549	0.339	0.851

Scale sub-dimensions	Categories	N	X̄	ss	F	p
	6–10 year	52	4.39	0.533		
	11–15 year	52	4.44	0.458		
	16–20 year	38	4.33	0.480		
	21 year and over	55	4.42	0.595		
Lesson Planning	0–5 year	24	4.43	0.448	0.843	0.501
	6–10 year	52	4.27	0.555		
	11–15 year	52	4.37	0.512		
	16–20 year	38	4.24	0.490		
	21 year and over	55	4.35	0.604		
Teaching Support	0–5 year	24	4.28	0.457	0.317	0.866
	6–10 year	52	4.28	0.549		
	11–15 year	52	4.34	0.504		
	16–20 year	38	4.23	0.458		
	21 year and over	55	4.26	0.645		
Adapting to Diversity	0–5 year	24	4.45	0.449	0.993	0.415
	6–10 year	52	4.24	0.601		
	11–15 year	52	4.39	0.498		
	16–20 year	38	4.28	0.507		
	21 year and over	55	4.32	0.591		
Classroom Management	0–5 year	24	4.30	0.410	0.609	0.657
	6–10 year	52	4.22	0.702		
	11–15 year	52	4.38	0.576		
	16–20 year	38	4.24	0.601		
	21 year and over	55	4.36	0.632		
Importance and Interest	0–5 year	24	4.36	0.508	0.915	0.459
	6–10 year	52	4.31	0.623		
	11–15 year	52	4.46	0.503		

Scale sub-dimensions	Categories	N	X̄	ss	F	p
	16–20 year	38	4.26	0.527		
	21 year and over	55	4.39	0.682		
Pedagogical Knowledge and Skills	0–5 year	24	4.39	0.406	0.655	0.625
	6–10 year	52	4.29	0.537		
	11–15 year	52	4.40	0.453		
	16–20 year	38	4.27	0.450		
	21 year and over	55	4.35	0.582		

Table 10 shows that middle school teachers' pedagogical knowledge and skill levels do not differ significantly according to their professional seniority ($p > .05$). The fact that teachers' pedagogical knowledge and skill levels do not differ according to the professional seniority variable can be explained by the fact that the mean scores for pedagogical knowledge and skill levels are close to each other across the scale and its subdimensions.

3.5. The Relationship Between Middle School Teachers' Curriculum Literacy Perception Levels and Their Pedagogical Knowledge and Skill Levels

The final sub-problem of the study, and in fact the core research question, examined whether there was a significant relationship between middle school teachers' perceptions of curriculum literacy and their levels of pedagogical knowledge and skills. In line with this research problem, a correlation analysis was performed, and Pearson's correlation coefficient was calculated; the findings are presented in Table 11.

Table 11 ***The relationship between middle school teachers' curriculum literacy perception levels and their pedagogical knowledge and skill levels***

		Understanding the curriculum	Implementing the curriculum	Valuing the curriculum	Questioning the curriculum	Curriculum Literacy Levels (Total)
Student Learning	*r*	.721	.699	.656	.605	.745
	p	<.001*	<.001*	<.001*	<.001*	<.001*
	N	221	221	221	221	221
Lesson Planning	*r*	.734	.722	.638	.598	.754
	p	<.001*	<.001*	<.001*	<.001*	<.001*
	N	221	221	221	221	221
Teaching Support	*r*	.735	.692	.630	.634	.750
	p	<.001*	<.001*	<.001*	<.001*	<.001*
	N	221	221	221	221	221

		Understanding the curriculum	Implementing the curriculum	Valuing the curriculum	Questioning the curriculum	Curriculum Literacy Levels (Total)
Adapting to Diversity	*r*	.775	.739	.658	.641	.787
	p	<.001*	<.001*	<.001*	<.001*	<.001*
	N	221	221	221	221	221
Classroom Management	*r*	.704	.672	.615	.582	.718
	p	<.001*	<.001*	<.001*	<.001*	<.001*
	N	221	221	221	221	221
Importance and Interest	*r*	.738	.709	.616	.589	.745
	p	<.001*	<.001*	<.001*	<.001*	<.001*
	N	221	221	221	221	221
Pedagogical Knowledge and Skills (Total)	*r*	.810	.778	.700	.670	.826
	p	<.001*	<.001*	<.001*	<.001*	<.001*
	N	221	221	221	221	221

Table 11 shows a highly significant positive correlation between middle school teachers' curriculum literacy perception levels and their pedagogical knowledge and skill levels (r = .826, p < .001). When the relationships between these skills of middle school teachers are examined in the context of scales and their subscales, the level of pedagogical knowledge and skills is positively and moderately correlated with the curriculum implementation subscale (r = .699, p < .001), curriculum valuing (r = .656, p < .001), and curriculum questioning (r = .605, p < .001) subdimensions, while a positive, moderately significant relationship was found with the curriculum recognition (r = .721, p < .001) subdimension. The lesson planning sub-dimension showed a highly significant positive relationship with the curriculum recognition (r = .734, p < .001) and curriculum implementation (r = .722, p < .001) subdimensions, and a positive, moderately significant relationship with the sub-dimensions of valuing the curriculum (r = .638, p < .001) and questioning the curriculum (r = .598, p < .001). The teaching support sub-dimension showed a moderately significant positive relationship with program implementation (r = .692, p < .001), curriculum appreciation (r = .630, p < .001), and curriculum questioning (r = .634, p < .001) subdimensions, while a positive, moderately significant relationship was found between the curriculum awareness (r = .735, p < .001) subdimension. The adapting to diversity sub-dimension showed a highly significant positive relationship with the curriculum recognition (r = .775, p < .001) and curriculum implementation (r = .739, p < .001) sub-dimensions, and moderately significant relationship with curriculum appreciation (r = .658, p < .001) and curriculum questioning (r = .641, p < .001). The classroom management sub-dimension showed a positive, moderately significant relationship with curriculum literacy levels across all sub-dimensions. The importance and interest sub-dimension showed positive, moderately significant relationships with curriculum appreciation (r = .616, p < .001) and curriculum questioning (r = .589, p < .001), and positive, high-level statistically significant relationships in the context of curriculum recognition (r = .738, p < .001) and curriculum implementation (r = .709, p < .001).

4. Conclusion and Discussion

Individuals' ability to adapt to their living conditions and meet their needs requires them to possess a range of skills in today's information society. Among these skills, literacy skills stand out as the most important, enabling individuals to think critically, analyze information, and use it effectively (Güneş, 2014). Teachers are the ones who lead the way in ensuring that students are educated to the desired level, adapt to their living conditions, and meet their needs. The curriculum is also designed to provide teachers with diverse perspectives. To make good use of the curriculum and effectively convey it to students, teachers need to be proficient in curriculum literacy. This study examines the relationship between middle school teachers' levels of curriculum literacy and their pedagogical knowledge and skills, and assesses whether differences exist across various variables.

The study revealed that middle school teachers have a relatively high level of curricular literacy. This finding can be explained by the fact that the participating teachers are proficient readers of the curriculum. According to Keskin (2019), a teacher who is well-versed in the curriculum is defined as someone who understands the structure of the curriculum, applies it effectively in the classroom, can critically evaluate the content, functionality, and relevance of the curriculum, and takes ownership of their professional responsibilities and fulfills them in the best possible way. When the studies were examined, it was concluded that teacher candidates and teachers had relatively high levels of curriculum literacy proficiency (Aslan, 2018; Aygün, 2019; Berberoğlu, 2023; Çetinkaya & Tabak, 2019; Dilek, 2020; Erdem & Eğmir, 2018; Gürbüz, 2021; Keskin, 2019; Süral & Dedebali, 2018; Tanaş, 2023).

The research concluded that middle school teachers scored highest on the "valuing the curriculum" dimension and lowest on the "questioning the curriculum" dimension. The low score on the questioning of the curriculum dimension indicates that middle school teachers do not critically evaluate the curriculum and instead accept it without question. According to Keskin (2019), in the dimension of questioning the curriculum, a teacher should critically evaluate the curriculum and analyze its applicability and relevance. This study is consistent with the results of Keskin's (2019) study. In Keskin's (2019) study, the highest average was observed for valuing the curriculum, while the lowest was observed for questioning the curriculum. In Berberoğlu's (2023) study, the highest dimension was valuing the curriculum, followed by implementing and recognizing the curriculum, while the lowest was observed in the dimension of questioning the curriculum.

When examining middle school teachers' curriculum literacy levels according to professional seniority and subject area variables, no significant differences were found. Studies by Gürbüz (2021) and Kale (2022) also found no significant differences in teachers' curriculum literacy skills according to professional seniority and subject area variables. According to Özer and Gelen (2008), teacher candidates have higher levels of curriculum literacy than serving teachers. No significant differences were found in middle school teachers' curriculum literacy perception levels by professional seniority across the sub-dimensions of recognizing, valuing, and questioning the curriculum. The difference observed between teachers with 11–15 and 16–20 years of seniority in implementing the curriculum dimension suggests a multidimensional relationship between professional experience and pedagogical skills. In the Turkish context, it is reasonable to assume that teachers in different seniority groups have experienced different curriculum reforms and participated in in-service training programs that vary significantly in timing, content, and quality. Recognizing this as a limitation is important for a more cautious evaluation of the data.

In Tanaş's (2023) study, teachers' curriculum literacy levels differed significantly by seniority across the sub-dimensions of "curriculum content" and "learning-teaching process." This difference was found to be in favor of new teachers. In the study conducted by Demir and Toraman (2021), a significant difference in the knowledge sub-dimension between curriculum literacies was found across subject areas, while no differences were observed in the other sub-dimensions or the overall average. Aslan and Gürlen's (2019) studies also show a difference in the subject area variable. Kahramanoğlu's (2019) study also supports the present study, as it found no statistical difference between curriculum literacy level and the professional seniority variable. Gürbüz's (2021) study found that Turkish and Turkish Language and Literature teachers had the highest level of curriculum literacy, as indicated by the subject-area variable. Çetinkaya and Tabak (2019), in their study of teacher candidates, found that teacher candidates preparing to become primary teachers were more knowledgeable about the curriculum than those preparing in mathematics and early childhood education.

It has been determined that middle school teachers generally possess pedagogical knowledge and skills above the scale average. This may mean that teachers not only have sufficient subject knowledge but also know how to convey this knowledge to students in the most effective way. According to Shulman (1987), teachers with sufficient pedagogical content knowledge are both proficient in the subject matter and know how to convey this content to students in the most appropriate way. A review of the studies (Bal & Karademir, 2013; Dikmen, 2023; Dilek, 2020; Doğangün, 2022; Güler, 2015; Işıkgöz et al., 2022; Wong et al., 2012; Zümrütyaprak, 2024) determined that teachers and teacher candidates consider themselves pedagogically competent. Işıkgöz et al. (2022) found that participants' pedagogical knowledge and skill levels were generally high. They demonstrated their pedagogical knowledge and skills most in the "student learning" dimension and least in the "teaching support" dimension. This is consistent with the results of the present study. Koca's (2019) study also concluded that the level of pedagogical knowledge and skills is generally high, with the highest skills in the "classroom management" dimension and the lowest in the "lesson planning" dimension. Middle school teachers' pedagogical knowledge and skill levels do not differ statistically with respect to professional seniority and subject area variables. The study conducted by Işıkgöz et al. (2022) also found no significant change in the pedagogical knowledge and skill levels of physical education teachers with respect to their professional seniority.

Based on the results of this study, there is a positive and significant relationship between middle school teachers' curriculum literacy levels and their pedagogical knowledge and skills. This result can be interpreted as meaning that teachers who are familiar with the curriculum, implement it effectively, and have positive attitudes towards it generally possess a high level of pedagogical knowledge and skills.

4.1. Limitations and Future Directions

This research was conducted on middle school teachers. The findings show that teachers have a high level of awareness of curriculum literacy, but they fall short in questioning and critically evaluating the curriculum. This situation reveals that teachers are unable to sufficiently analyze the philosophical, social, and pedagogical foundations of the curriculum. Therefore, it is recommended that practical courses that question the fundamental bases of the curriculum and encourage critical thinking be added to teacher training programs. It is believed that a course specifically titled "Curriculum Literacy and Critical Thinking" would contribute to developing teacher candidates' ability to analyze, compare, and evaluate curricula from a critical perspective. Furthermore, offering

similar content within in-service training programs for current teachers could be effective in increasing curriculum literacy.

Based on the research findings, recommendations can be made to inform future studies. Similar studies can be conducted with larger samples and in different regions. The scope of the research can be expanded by including variables not covered in this study, such as the type of school graduated from, age, and department. Additionally, it is recommended that qualitative research be conducted on the relationship between teacher candidates' or teachers' curriculum literacy levels and their pedagogical knowledge and skills.

5. Declarations

5.1. Author Contributions (CRediT)

Author 1 (Hürrem Evli): Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing—original draft; Writing—review & editing; Visualization.

Author 2 (Sanem Tabak): Conceptualization; Methodology; Validation; Supervision; Writing—review & editing.

5.2. Conflict of Interest

Our article titled "Examination of Curriculum Literacy and Pedagogical Knowledge and Skill Levels of Secondary School Teachers" has no financial conflict of interest with any institution, organization or person. There is also no conflict of interest between the authors.

5.3. Funding Statement

This research received no external funding.

5.4. Data Availability Statement

Due to ethical considerations and participant confidentiality, the quantitative data are not publicly available but may be obtained from the corresponding author upon reasonable request.

5.5. Ethics Approval

Ethical approval for this study was granted by the Ordu University Education Research Ethics Committee (Approval No: 2023-216; Approval Date: 07.12.2023). This study complies with all the rules specified in the Higher Education Institutions Scientific Research and Publication Ethics Guidelines. All participants were informed about the purpose and scope of the research, and confidentiality and anonymity of data were ensured. Written informed consent was obtained from all participants prior to data collection.

5.6. Use of Artificial Intelligence (AI) Tools

Only AI-powered tools were used in the language editing process of this article. No AI-powered tools were used in any other section of the article.

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Growing up as a child with hearing loss in a deaf family

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ABSTRACT

While children with hearing loss born to Deaf parents experience unique developmental and communicative trajectories, conventional early intervention systems often lack the flexibility to support their specific multimodal needs. To address this gap and develop more inclusive models, it is crucial to closely examine the lived experiences of these families. This qualitative single-case study examines the communication dynamics, developmental needs, and ecological challenges faced by a child with profound hearing loss raised in a Deaf household in Türkiye. Data were collected during a four-day intensive playgroup project (PGP) and triangulated through the first author's observations, educator journals, semi-structured interviews, and document analysis. The findings reveal that despite restricted spoken language input, the child demonstrated active engagement and quick adaptation to multimodal communication strategies, combining gestures with emerging vocalizations. However, systemic and sociocultural barriers, such as intergenerational communication differences and educational disruptions due to seasonal agricultural relocations, significantly hindered progress. Ultimately, this case underscores the inadequacy of exclusive, child-centered therapy models for this demographic. To better support these families, early intervention policies must shift towards holistic, family-centered approaches that respect the family's unique linguistic landscape and provide continuous, accessible, and culturally sensitive pedagogical support.

KEYWORDS: Deaf culture; Child with hearing loss; Bilingual/bicultural approach; Multimodal communication

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1. Introduction

1.1. Communication and Hearing Loss in Early Childhood

The ability to communicate closely correlates with the capacity to exist meaningfully within society. From birth, infants engage in communicative interactions; indeed, the neurobiological foundations of language, such as the lateralization of speech discrimination, are evident even in newborns (Bartha-Doering et al., 2025). Contemporary research indicates that early triadic encounters during the first few months seamlessly scaffold later non-verbal communication. Rather than individual milestones, infants cultivate a complex array of prelinguistic behaviors, including pointing, gaze following, and synchronized vocalizations, which emerge towards the end of the first year to convey communicative intent and significantly predict long-term vocabulary development (Çetinçelik et al., 2021; Mendoza-García & Moreno-Núñez, 2023). Despite variations in the functional and effective use of language

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influenced by diverse environmental factors, all infants possess an innate neurobiological potential for language acquisition, with early neural speech processing reliably predicting later grammatical proficiency (Zhao & Kuhl, 2021). To actualize this potential, access to language has historically been deemed essential, primarily via auditory exposure and spoken language input. Recent research emphasizes that early language acquisition is fundamentally multimodal, arising from infants' ongoing integration of auditory stimuli with visual articulation, gestures, and precisely timed caregiver interactions (Göksun et al., 2024; Karadöller et al., 2025; Mason et al., 2019). To understand the early language experiences of children with hearing loss, one must closely examine the family, linguistic, and cultural environments in which they grow up.

Approximately 10% of children with hearing loss are born into families in which at least one parent is Deaf or hard of hearing (Mitchell & Karchmer, 2004). Notably, the majority of Deaf parents have hearing children, and many of these children grow up culturally Deaf, having full access to sign language and the values of the Deaf community from birth (Bishop, 2012). These children often experience distinct language and communication development pathways compared to their peers raised by hearing parents (Rose et al., 2004). When exploring the diverse linguistic environments in which children of Deaf adults are raised, it is important to consider the unique dynamics that shape their early communication experiences. Hearing children of Deaf parents often grow up balancing two cultural and linguistic identities, frequently acting as informal mediators between their Deaf families and the hearing world, a role that can be both socially complex and emotionally challenging (Singleton & Tittle, 2000). These complex identity negotiations are closely intertwined with the linguistic input children receive at home, which is itself deeply influenced by their parents' hearing status.

Parental hearing status plays a critical role in shaping the linguistic environment of children with hearing loss, particularly the frequency and consistency of sign language use. Children with at least one Deaf parent are significantly more likely to be exposed to regular signing, while children with only hard-of-hearing parents tend to encounter sign language less consistently, both at home and in educational settings. Furthermore, this distinction often reflects broader intergenerational hearing patterns; for example, families in which both parents and children are Deaf or have hearing loss, where language use patterns may reflect not only cultural transmission but also hereditary factors (Mitchell & Karchmer, 2005). In addition to the type and consistency of input, the age at which language exposure occurs plays a pivotal role in shaping developmental trajectories. Mayberry (2007) highlighted that the age at which a person acquires their first language (whether spoken or signed) has a major impact on their long-term ability to learn and use language. Findings show that language development depends primarily on how the brain processes language (Petitto & Marentette, 1991) rather than on the way it is received (auditory or visual) or produced (spoken or signed). This supports the broader understanding in cognitive science that early and consistent exposure to an accessible first language is essential for strong and lasting language skills throughout life.

1.2. Communication Modalities, Language, and Cultural Contexts in Deaf Families

While all children benefit from a rich linguistic environment, language acquisition dynamics become more complex in families with diverse hearing profiles. Ecological theory emphasizes that language development is intricately linked to the child's microsystem, encompassing their immediate familial and sociocultural environment. It depends not solely on a parent's linguistic capabilities but also on the quality of daily, reciprocal interactions (Bronfenbrenner, 2000). Consequently, the type of linguistic input and communication modality is critical in shaping early outcomes (Gathercole & Hoff, 2007). Deaf parents often provide rich, multimodal early communication through voice, manual signs, and physical contact, which promotes foundational language development regardless of the

child's hearing status (Moores, 2001). Communication patterns in Deaf-parented families frequently differ from those in hearing-parented families, where language choices are usually influenced by medical advice and societal norms. In many such cases, spoken language takes precedence, which can lead to restricted spoken language if the child is unable to fully access auditory input (Lillo-Martin et al., 2021).

Sign language is a central modality for Deaf parents, who use it with their children regardless of hearing ability. Despite their unique efforts, hearing parents may be reluctant to learn sign language, and their proficiency is often basic to intermediate (Mallory et al., 1993; Lieberman et al., 2022; Pontecorvo et al., 2024). Some families use a bimodal bilingual approach, which includes both sign language and spoken language, particularly when guided by early intervention programs. Studies have demonstrated that these methodologies promote language development without impeding speech acquisition (Szarkowski et al., 2024; Joy et al., 2024). In addition to these primary modalities, families use visual and tactile strategies, including gestures, facial expressions, and touch, as well as assistive technologies to improve communication. Deaf parents demonstrate greater efficacy in employing visual-tactile methods with Deaf children than hearing parents, who predominantly rely on oral-aural strategies (Beatrijs et al., 2019; Depowski et al., 2015). Moreover, augmented reality tools and other assistive technologies are progressively employed to address communication barriers in mixed-hearing families (Meinzen-Derr et al., 2021; Mood et al., 2022).

In summary, spoken language is predominantly emphasized in families with hearing parents and Deaf children, whereas sign language and bimodal communication are more common and seamlessly integrated in families with Deaf parents and hearing children, providing essential insights into how communication modalities influence and reinforce cultural and developmental outcomes. In this context, certain children may emerge as bimodal bilinguals, employing both spoken and signed languages, which entail distinct perceptual and expressive modalities (auditory and visual, and vocal tract and hands), thereby introducing unique dimensions to their communicative development (Bishop, 2012). Furthermore, with over 34 million children worldwide living with disabling hearing loss, defined as hearing loss greater than 35 dB in the better ear, there is a pressing need to explore diverse communicative and cultural contexts, especially as prevalence is projected to rise (WHO, 2021). Despite the unique position of children raised in Deaf families, this subgroup remains relatively underexplored in the literature, highlighting the importance of nuanced, context-sensitive research.

Children with hearing loss raised in Deaf culture may utilize sign language, spoken language, or adopt a bilingual/bicultural methodology. These communication modes are not simply linguistic selections but are ingrained in the cultural and social values of the communities that nurture children. Deaf culture, characterized by visual communication and a collective identity, provides a distinctive environment conducive to early language development when consistent access to language input is available from birth. Nonetheless, access to such resources is not assured in all households. Certain families encounter significant communication difficulties, often stemming from inadequate sign language proficiency and vocabulary disparities between parents and children (Wilhelm, 2006). Compelling evidence indicates that children who receive support through bilingual/bicultural methods exhibit enhanced outcomes across multiple developmental domains, including language (spoken and signed), cognition, and social-emotional well-being (Dammeyer, 2014; Haualand & Grnnings, 2003; Swanwick, 2010). Such methodologies validate the significance of both signed and spoken languages and encourage adaptability in communication, particularly advantageous in multilingual and multicultural contexts. Parental communication preferences significantly influence children's communicative (Nittrouer et al., 2020), cognitive (Yu et al., 2021), and academic

development; therefore, educational systems must be equipped to address diverse linguistic requirements.

Nonetheless, various challenges have been documented concerning the effective execution of these methodologies in Türkiye (Akmeşe & Kayhan, 2016; Selvi & Yıldırım, 2023; Zeshan, 2003a). In Türkiye, obstacles remain in the execution of bilingual/bicultural models. Inadequate early intervention programs, insufficient teacher training in alternative communication methods, and systemic obstacles to accessible education impede the consistent implementation of inclusive strategies (Akmeşe & Kayhan, 2016; Baş et al., 2019; Yıldız & Kaya-Çelik, 2024). Consequently, many children with hearing loss may not receive the timely or culturally appropriate support they need, highlighting the urgent need for policies and practices that align with the language and culture of hearing or Deaf families.

1.3. Research in Türkiye

Many studies in Türkiye have examined the roles and experiences of hearing children with Deaf parents (Bülbül & Poyraz, 2023; Odabaş, 2024; Seven & Göl-Güven, 2016), the experiences of hearing people with family members who have hearing loss (Arsan & Uzuner, 2023; Çolaklıoğlu et al., 2019), and the parenting experiences of Deaf adults (Altuntaş & Karataş, 2025). Although these studies provide important information about how children grow up in Deaf culture in Türkiye, they offer very little information about children with two Deaf parents or those raised in homes that use both sign language and spoken language simultaneously.

Despite the limited empirical research, several studies have shed light on the historical, linguistic, and sociocultural contexts of the Deaf community in Türkiye. Zeshan (2003b) observed that although Deaf individuals in Türkiye have established robust social structures, especially in sports, cultural productions such as sign language theater and literature are underdeveloped. This context indicates a substantial deficiency in the development of cultural identity and historical memory among the Turkish Deaf community. Kemaloğlu and Kemaloğlu (2012) asserted that the exclusive use of hearing aids and speech-based rehabilitation has often proved inadequate to safeguard the physical, mental, and social well-being of children with hearing loss in Türkiye. Furthermore, sign language should not be regarded merely as an educational instrument but as a legally requisite mode of communication in various public services, including healthcare. The authors contended that institutions, such as hospitals and clinics, must be reformed to meet the communication requirements of Deaf individuals via sign language (Kemaloğlu & Kemaloğlu, 2012). The macro focus of existing literature underscores the imperative for a more comprehensive understanding of the intricate experiences of individuals with hearing loss and Deaf families in Türkiye, particularly regarding intra-household communication, an area that remains largely unexamined.

1.4. Research Aims

Despite the growing recognition of the importance of bilingual and culturally aware teaching methods, there remains limited understanding of the intra-household communication dynamics of children with hearing loss raised by Deaf parents, especially when different communication methods are used (Szarkowski et al., 2024). Current research primarily focuses on children with hearing loss who are born to hearing parents or isolates language outcomes, creating a significant gap in understanding the relational dynamics and communication strategies within culturally Deaf family contexts. Language development in children is influenced by various factors, including their cultural environment, socioeconomic status, and the overarching legal and policy frameworks that govern access to early intervention and education. For children with hearing loss, the method of

communication and the quality of linguistic input are particularly vital, especially during the sensitive developmental period from birth to age three. Parents, siblings, and other primary caregivers play a vital role in shaping communication outcomes and promoting early development (Bat-Chava & Martin, 2002). Considering these complexities, it is imperative to analyze real-life household interactions within families comprising Deaf parents and a child with hearing loss. This focus aims to enhance the understanding of how communication is negotiated, facilitated, and maintained within the home environment, ultimately shaping the child's developmental and linguistic trajectory.

This case study enhances the literature by providing a comprehensive, contextualized examination of a culturally Deaf family's communication strategies for their child with hearing loss, particularly in a setting that employs multiple communication modalities. This study aims to thoroughly explore the life of a child with hearing loss born to Deaf parents, focusing on the child's growth, education, and communication needs within a Deaf family that uses multiple modes of communication. Additionally, it investigates the challenges Deaf parents face in promoting their child's linguistic and educational development within a framework often shaped by hearing-oriented norms and practices. To address these aims within the context of a lived experience, the study is guided by the following research questions: (1) What are the characteristics of the family in which a child with hearing loss was born? (2) What are the child's comprehensive developmental, audiological, and educational needs? (3) What specific challenges does the family encounter in raising the child with hearing loss?

Aycan's Story

This case study centers on Aycan (pseudonym), a young girl with hearing loss who was born to Deaf parents. Aycan's story serves as an example of how bilingual communication, hearing loss, and family culture interact in a Deaf home. Her family speaks Turkish Sign Language (TİD) in their small northern Turkish city, but they also use spoken Turkish when they talk to hearing family members and teachers. Both her mother's active involvement in the Deaf community and the family's restricted access to specialized educational support influenced Aycan's early developmental experiences. Depending on the situation and the other person, she uses various modalities in her everyday communication, including lip-reading, home signs, gestures, and occasionally spoken words.

Both of Aycan's parents are members of the Deaf community; however, her mother represents a distinct profile within Deaf culture compared to both the broader Deaf community and Aycan's father. During the data collection period, Aycan's mother was 36 years old. She attained her primary education in the family's hometown and commenced her secondary education in the sole special education classroom available in the city at that time, but subsequently relocated with her family to Istanbul, where she was educated alongside peers with hearing loss during the early years of middle school before completing her education in a mainstream classroom setting. Upon finishing secondary education, she joined the workforce, serving as a seasonal hazelnut laborer in her hometown during the summers and in the textile industry in Istanbul. Concerned that communication exclusively via sign language and lip reading would be inadequate, Aycan's mother pursued a cochlear implant candidacy evaluation and received the implant at the age of 30. This decision profoundly impacted Aycan's developmental path. The mother emphasized the importance of sign language while also expressing a strong desire for Aycan to acquire spoken language skills. Due to the type and degree of Aycan's hearing loss, she was not eligible for cochlear implantation and instead uses bilateral behind-the-ear (BTE) hearing aids.

At 12 months old, Aycan began receiving early intervention services at a Special Education and Rehabilitation Center (SERC). According to the SERC director, Aycan did not consistently attend

intervention sessions throughout the summer. To mitigate these disruptions, the director indicated that supplementary initiatives would be undertaken to invite Aycan to the center and enhance her exposure to spoken language. The SERC facilitated Aycan's participation in a playgroup program to enhance her developmental progress. At the time of data collection, Aycan was in the process of enrolling in kindergarten. Her mother and maternal aunt, serving as an interpreter, reported persistent efforts to ensure Aycan's enrollment in a full-time preschool program. Aycan's mother, Mrs. Ayşe, also has six siblings. One of them is also a member of the Deaf community. Besides this, Aycan's aunt's child has congenital hearing loss. This cousin received an early diagnosis, was provided with hearing aids, and has consistently participated in educational programs. They can now engage in verbal communication with their peers while using their hearing aids. During the summer months, Aycan regularly socializes and plays with her cousins, a group that includes both hearing children and those with hearing loss, all of whom are in a similar age range. According to the aunt, these seasonal interactions provide notable developmental benefits for all children involved. Moreover, video-mediated communication on social media platforms is integral to Aycan's daily life, facilitating continuous visual engagement with family members and supporting her communicative development (Interview, lines 446–448). Aycan's story offers a contextualized explanation of how language use, hearing loss, and family culture interact in a Deaf parent's day-to-day life.

2. Methods

2.1. Research Design

This study was structured as a comprehensive single-case analysis to systematically investigate the experiences presented in Aycan's story. This method facilitates a comprehensive and contextual examination of a phenomenon in its natural environment (Bogdan & Biklen, 2007). The design seeks to elucidate the developmental traits and distinct needs of a child with hearing loss who is born to Deaf parents. This qualitative study aims to develop a thorough understanding of the child's linguistic, communicative, and educational experiences by synthesizing data from various sources and viewpoints.

2.2. Participants

The case centers on a child with hearing loss, Aycan, who was born into a Deaf family. Additional participants included the child's mother, two maternal aunts, special education teachers, the principal of the child's school, and the instructors of the playgroup program the child attended (Table 1). All participants were apprised of the research objective, and their involvement was voluntary.

Table 1 ***Key Individuals in Aycan's Family and Social Environment***

Pseudonym	Relationship to Aycan	The Role in Aycan's Life	Hearing Status	Primary Communication Mode
Ahmet	Father	Limited interaction: infrequent in-person contact and occasional video calls	Deaf	Turkish homesign
Ayşe	Mother	Primary caregiver; lives with Aycan	Deaf / restrictive spoken language	Turkish homesign; limited spoken words

Pseudonym	Relationship to Aycan	The Role in Aycan's Life	Hearing Status	Primary Communication Mode
Ayşe's mother	Grandmother (maternal)	Regular contact during visits to grandmother's village home	Hearing	Spoken Turkish
Ayşe's sister	Maternal aunt	Lives in the same city; occasionally acts as an interpreter and supports official procedures	Hearing	Spoken Turkish
Ayşe's older sister	Maternal aunt / mother of a child with hearing loss	Lives in a different city; frequent summer contact; supports Aycan's language development using strategies learned for her own child	Hearing	Spoken Turkish

2.2.1. Researcher and Participant Researcher Role

In this study, the first author served as a participant observer, initiating the primary interaction with Aycan. Specifically, the researcher served as one of Aycan's special education teachers in a playgroup program. To preserve the natural dynamics of the family environment, the researcher made a conscious effort to maintain a strictly non-interventional stance outside the play sessions throughout the entire data collection process (Christensen et al., 2015). Furthermore, in adherence to ethical research practices, once the data collection phase was complete, the researcher provided tailored guidance and recommendations regarding Aycan's development to her family and to the director and teacher of the SER upon their explicit request.

2.3. Data Collection

To ensure data richness and triangulation, a variety of qualitative methods were utilized (Table 2). These included semi-structured and unstructured interviews, the first author's observations during the playgroup project (Ertürk-Mustul & Baş, 2024), document analysis, and the reflective journals of both the first author and the playgroup special education teacher. All data were collected between May 30, 2024, and September 15, 2024. A semi-structured interview was conducted with the Deaf mother after obtaining informed consent. Prior to the interview, the study's objectives and methodology were thoroughly explained. At the mother's request, her hearing sisters (the child's aunts) participated in the session to facilitate communication across Turkish Sign Language, Turkish homesign, and spoken Turkish as needed. The mother primarily relied on lip-reading and articulated her thoughts independently; in instances of doubt, she sought counsel from her sister. The assembled dataset comprises two semi-structured interviews, two unplanned observations at the SERC, four institutional documents (including educational assessment forms and Special Needs Report for Children), a teacher's journal from the Play Group Program, and six pages of researcher field notes. A data collection matrix is presented in Table 2 to ensure methodological transparency and to clearly demonstrate the alignment between the research questions and the collected data.

Table 2 *Data Collection Matrix*

Research Questions	Observations Play Group	Observations Home	Family Interviews	Documents	Journals Teacher	Journals Researcher
What are the characteristics of the family into which the child with hearing loss was born?			X	X		X
What are the child's comprehensive developmental, audiological, and educational needs?	X		X	X	X	X
What specific challenges does the family encounter in raising the child with hearing loss?	X		X	X	X	X

Note. * Refers exclusively to the observational data collected by the first author. ** The research diary maintained by the project coordinator (a special education teacher and non-author) was incorporated into the analysis with explicit prior permission.

2.3.1. The Play Group Program

The Play Group Program (PGP) offers early intervention services that create a stimulating environment for young children (0–3 years) and their parents to engage with peers, thereby promoting holistic development and enhancing interactions among parents and between parents and children (Finch, 1984; Hancock et al., 2012; McLean et al., 2014). During the data collection period, Aycan and her mother participated in a distinctive four-day intensive PGP entitled "Learning with Play: Playgroup Program for Children with Special Needs and Their Mothers," endorsed by the Scientific and Technological Research Council of Türkiye (TÜBİTAK), from September 3 to September 6, 2024. The daily schedule of the program included free play, circle time, art, music activities, and snack time. The program was conducted by researchers and educators specializing in special education with a focus on hearing loss. They closely observed Aycan and her mother, evaluated the child's developmental milestones, and provided targeted pedagogical recommendations to the family (Ertürk-Mustul & Baş, 2024). As a rare opportunity to observe Aycan in a structured, language-rich social environment, the PGP provided a significant portion of the qualitative dataset for this study. This four-day intervention produced reflective field journals of the special education teacher who led the PGP, a detailed researcher journal from the first author, who was also a PGP researcher, as well as various developmental documents.

2.4. Data Analysis

All data were analyzed using a descriptive analysis approach (Yıldırım & Şimşek, 2021). The analysis consisted of two stages: preparation and the analytical process. During the preparation stage, the interviews were transcribed, and the accuracy of these transcriptions was verified by an independent special education teacher. Observations, researcher diaries, interviews, and documents were compiled to establish a comprehensive dataset. Within this dataset, the first author conducted the

primary analysis, while the second author, who was not involved in data collection, provided critical feedback on the descriptive categories. Consequently, the findings were organized into three primary categories to directly address the research questions. In presenting the findings, direct quotations from the observation and interview data were included to enhance the transparency and credibility of the research (Gay et al., 2012; Yıldırım & Şimşek, 2021).

2.5. Credibility and Ethical Considerations

Methodological triangulation was utilized to enhance credibility and trustworthiness by integrating various data collection techniques (Brantlinger et al., 2005). The researcher (first author) meticulously documented field notes and reflective journals from the commencement of the study. The accuracy of the data was confirmed via transcript verification, and multiple readings facilitated a comprehensive understanding. Direct quotations were employed to accurately convey the participants' perspectives. Pseudonyms were allocated to all participants, and identifying information, including city names, was eliminated to maintain confidentiality. All procedures were executed in compliance with ethical research standards. Ethical approval was obtained from the Ordu University Ethics Committee (Decision No. 2024-151, October 25, 2024).

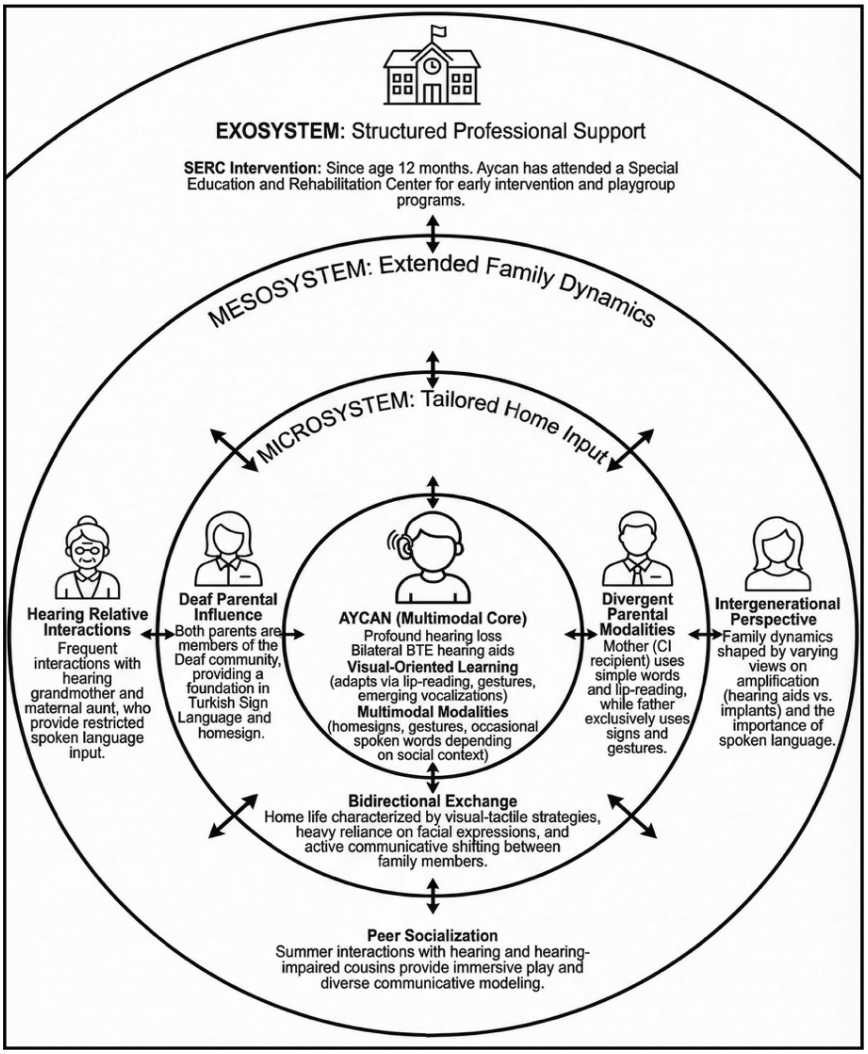
3. Results

This study aimed to thoroughly investigate the experiences, needs, and dynamics of a family raising a child with hearing loss, with particular emphasis on the distinctive context of deaf parents. After conducting a thorough descriptive analysis of the triangulated data, the findings were organized to directly respond to the primary research questions. Consequently, the findings were organized into three primary descriptive categories corresponding to the research questions: (1) the attributes of the family environment into which the child was born; (2) the holistic developmental, audiological, and educational needs of the child; and (3) the particular difficulties faced by the family in nurturing the child.

3.1. Family Characteristics and Communication Dynamics

The initial research question aimed to define the attributes of the family environment in which a child with hearing loss is born. The findings indicate that Aycan is currently being reared by a single parent with substantial support from an extended family network. Just prior to the initiation of the data collection phase, Aycan began residing solely with her mother. Thus, her principal communicative and social network consists of a closely connected group of maternal relatives, namely, her mother, grandmother, and aunt. These individuals form the foundation of her daily upbringing, providing essential context for her linguistic development and social interaction. Despite the father's inclusion in her broader family network, Aycan's direct and frequent interactions primarily stem from her maternal extended family. A summary describing Aycan's family and the relatives with whom she interacts most frequently is depicted in Figure 1.

Figure 1 *The communicative approaches and changes within Aycan's ecological systems*



Note. The figure illustrates Aycan's ecological systems and communicative dynamics.

An important aspect of family traits relates to communication methods. Aycan's parents were both raised in Deaf culture; however, their preferred methods of communication differed. Mrs. Ayşe, Aycan's mother, is an adult with a late diagnosis of profound hearing loss who lacked access to early childhood special education. She spent most of her primary school years in a special education classroom with deaf peers at a public school, ultimately completing her primary and secondary education in inclusive general education settings in another city. At the age of 30, Mrs. Ayşe underwent cochlear implant surgery to enhance her spoken language abilities (Information form, August 2, 2025). She stated that conventional hearing aids were insufficient for her needs and that the cochlear implant greatly enhanced her auditory comprehension. This experience was shared during an interview mediated by her sister (Interview, lines: 266–269):

> Researcher (R): "So, is the device good? Does she recommend it to everyone?"
>
> Mrs. Ayşe: "Good, everyone should get it. [She] doesn't understand the other device. This is better."
>
> R: "The implant?"
>
> Aunt: "She says the implant is better. Because the sound goes to the brain. She understands."

Mrs. Ayşe reported enhanced auditory perception following implantation, noting that she had primarily relied on lip-reading for receptive communication. She attempted to communicate using limited, simplistic, single-word expressions (Playgroup project observation; researchers' journal, line: 46). The complexities of interacting with Mrs. Ayşe are further detailed in the researcher's field notes, which highlight the reliance on non-verbal cues:

> Researcher's journal, line 46: "Mrs. Ayşe explained to me that Aycan is always this insistent at home and is resistant when it comes to getting what she wants. Of course, it was not easy for me to understand this. I managed to comprehend it by closely following the gestures and facial expressions of both Mrs. Ayşe and Aycan."

Ultimately, the data indicate that Mrs. Ayşe's primary communication modalities included articulation of simple single words, lip-reading, and home signing. Information about Aycan's father, Mr. Ahmet, was obtained exclusively from the accounts provided by Aycan's mother and maternal aunt. Mr. Ahmet and Mrs. Ayşe attended the same primary school (information form, August 2, 2025), and Mr. Ahmet is a high school graduate. He is presently engaged in a minimum-wage income-generating role. At the time of data collection, he and Mrs. Ayşe were in the process of divorcing. Mr. Ahmet exclusively utilized sign-based communication and encountered considerable challenges with lip-reading (interview, line: 490). His communication modality and interactions with Aycan are further elaborated in the following interview excerpt (interview, lines: 486–492):

> R: "How is Aycan's relationship with her father? Does Aycan talk to her father?"
>
> Mrs. Ayşe: "Hand signs."
>
> R: "Fingerspelling... Does Aycan understand?"
>
> Aunt: "She doesn't understand [complex signs]; she understands from gestures. [Things like] 'let's go,' 'let's come'... but right now, her husband cannot speak either. I tell him, 'Don't use gestures,' but he can't speak. What is he forced to do? He has to use gestures; he cannot speak, no sound comes out right now."

In addition to her immediate parents, Aycan's extended family plays a crucial role in her social environment. During the three-month summer vacation, when schools are closed, Aycan frequently stays at her maternal grandmother's village house and at her city-center residence. The grandmother, who has typical hearing, spends a significant amount of time with Aycan. Furthermore, during the summer months, Aycan's hearing-impaired cousins also visit the grandmother's house for extended periods. Aycan regularly interacts and plays with these cousins, particularly with a hearing-impaired cousin of a similar age. This cousin has profound hearing loss, but was diagnosed early and immediately began receiving special education. Although slightly delayed relative to typical developmental milestones, this cousin uses spoken language in a manner highly comparable to that of hearing peers (Interview, lines: 642–646). Consequently, Aycan benefits from approximately one month of immersive play and communication with her cousins each summer. Aycan's maternal uncle experiences post-lingual hearing loss; however, he maintains the capacity for speech. However, his direct interactions with Aycan are relatively infrequent.

In summary, rather than a static demographic background, Aycan's family structure constitutes a highly dynamic and complex linguistic ecology. She is maturing in an environment that requires her to continuously navigate diverse communication modalities, from tailored homesign with her Deaf parents to restricted spoken language with extended family members. Furthermore, the varying intergenerational perspectives on deafness, amplification, and spoken language actively shape the daily input she receives. Consequently, this profound reliance on customized gestural

communication establishes a distinctive developmental context. This unique familial landscape not only describes her background but also actively dictates the highly specific communicative, audiological, and educational pathways she requires.

3.2. Aycan's Comprehensive Developmental, Audiological, and Educational Needs

The second research question aimed to identify the child's comprehensive developmental, audiological, and educational needs within her unique familial context. During the data collection period, Aycan was approximately three and a half years old. She received a diagnosis of profound bilateral hearing loss after newborn hearing screenings and was fitted with her initial bilateral hearing aids at six months of age (information form, August 2, 2025). According to her mother's statements, Aycan uses her hearing aids consistently. Educationally, Aycan has been attending an SERC since approximately age 1. Nonetheless, her formal education undergoes an interruption of nearly two months during the summer. This disruption was linked to the family's seasonal move to her grandmother's village. Aycan's maternal aunt expressed this interruption of routine:

> Interview, lines 773–774: "Aycan might not be able to go [to the center] in August; it's hazelnut season now, so Ayşe will be going to the village. She'll be spending some time here and some time there."

Aycan, who experienced early childhood during the COVID-19 pandemic, spent a significant portion of this critical developmental period at home with her deaf parents. At the time of the study, her social interactions were limited to family members residing with her mother and grandmother. Observations from a PGP aimed at enhancing her communication abilities indicated that Aycan had restricted access to spoken language. Instead, she primarily communicated using sign-based representations, similar to those used with her father, and demonstrated a strong reliance on lip-reading. Despite this restricted spoken language input, observations by the special education teacher and researcher in the PGP revealed that Aycan demonstrated active communicative efforts and high engagement during the sessions. The special education teacher, an expert in hearing loss, evaluated Aycan on the first day of the PGP, emphasizing her core strengths and the urgent need for appropriate linguistic input:

> Teacher's journal, September 3, 2024: "I didn't hear much expressive language while she was playing with me, but I heard more when she played with the researcher. Even though she does not hear spoken language [in her daily environment], she is in a very good state. She is a child who could be exceptional if adequately exposed to spoken language."

The immediate impact of a language-rich environment became evident by the second day of the program, as Aycan quickly began to express herself using single words (Researcher's journal, September 4, 2024). The researcher documented this rapid expressive language emergence in the field notes:

> Researcher's journal, September 4, 2024: "The beautiful thing was that Aycan started saying 'öretmen' [target word: öğretmen (teacher); demonstrating phoneme omission], pointing to me [the other special education teacher], and occasionally the project team throughout the day. It was particularly beneficial for her to play with the doll and the doctor's outfit. She has started to express herself more confidently. At times, when a friend took her toy, she got angry at her mom and said, 'menim, al' [target word: benim (mine); demonstrating phoneme substitution]. While looking at the storybook, she frequently spoke spontaneously, supplementing her spoken words with gestures and facial expressions."

Aycan participated in the PGP alongside her mother for four consecutive days. The daily schedule of this intensive program consisted of free play, circle time, sensory and music activities, and snack time. During free play sessions, Aycan actively interacted with her mother and peers, participated in circle time, and consistently endeavored to express her thoughts and needs during her turn in all activities. By the fourth day of the program, observations indicated that Aycan increasingly attempted to combine vocalization with her requests. The special education teacher documented this rapid progression in expressive communication:

> Teacher's journal, September 6, 2024: "While playing with Aycan, I turned my back for a moment, and she called me by touching my shoulder. I told her, 'You can say öğretmenim bak [my teacher, look].' I only modeled it once. A considerable amount of time passed; I believe it was after the sensory play. Aycan had climbed the climbing wall. She called out to me, shouting, 'Öğretmeeen bak' [Teeeacherrr, look]."

Moreover, the PGP observations indicated that Aycan had the inherent ability to construct basic, two-word, action-oriented sentences when given suitable linguistic stimuli. The researcher detailed the emergence of these expressive language milestones in field notes:

> Researcher's journal, September 3, 2024: "Today, Aycan formed simple two-word sentences such as 'elma bitti' [apple finished], 'elma yedi' [ate apple], and 'bebek istiyo' [baby wants]."

At the conclusion of the PGP, during the evaluation team meetings, the special education teacher and researcher reached a consensus: in comparison with the first day, Aycan exhibited increased effort to combine vocalizations with her gestural communication and demonstrated a sustained willingness to express her requests interactively. Qualitative observations highlighted Aycan's active engagement in daily routines and play. Specific instances demonstrating her cognitive and motor participation during these activities were noted in the special education teacher's journal:

> Teacher's journal, September 3, 2024: "Her symbolic play skills were well-developed, as were her fine motor skills... She tracked her environment beautifully, and her reactions and responses were excellent."

Furthermore, the researcher noted the child's ability to engage in complex play despite communication barriers:

> Researcher's journal, September 3, 2024: "I observed that Aycan, whose mother is deaf, sets up play scenarios beautifully... Aycan and her mother played a doll dressing game. The mother demonstrated how to feed the baby and comb its hair. Together with her child, they braided the toy doll's hair."

Despite these strengths, the special education teachers found Aycan's rapid ability to engage in play with peers and her emerging use of multimodal communication particularly noteworthy given the short timeframe. Aycan is a child with profound hearing loss who is growing up in an environment characterized by restricted spoken language input, limited peer interaction, and, largely due to the pandemic, a history of being confined to the home setting with her deaf parents. The extent of her limited social engagement prior to the program was emphasized by her aunt, who noted her restricted interactions even in public spaces like playgrounds:

> Interview, lines 394–395: "She doesn't speak; she is alone... Well, they go [to the park] a lot, but always by herself... her mother pushes her on the swing, the slide next to her mother... honestly, there isn't that kind of [social] environment in the parks."

Given this isolated background, the teachers found Aycan's better-than-expected skills, such as interacting with peers, expressing her desires, and clearly conveying dissent during play, to be noteworthy. The special education teacher reflected on these dynamics and offered potential explanations for her high level of engagement and readiness for structured learning:

> Teacher's journal, September 6, 2024: "I found it quite interesting that a child with so little exposure to spoken language could suddenly produce these words (like 'öretmen', 'bak' [teacher, look]). Two possibilities came to my mind... The second possibility is that, being a highly intelligent child, she benefited immensely from the four-day spoken environment, and a miracle happened. Or, because the grandmother and others use spoken language at home, she is already benefiting there; however, since the mother does not speak, she primarily relies on gestures and facial expressions. Regardless, for a child who hears and uses spoken language so little, I think Aycan is in a very good state... I believe Aycan's potential is excellent. Besides all this, Aycan is a child who understands boundaries very well, accepts them, and can express her wants or desires, even if through signs."

In light of these positive qualitative observations from the educator and the researcher concerning Aycan's active participation, a decision was made to conduct a formal evaluation of her cognitive development. An assessment practitioner with specific expertise in the cognitive evaluation of students with hearing loss was requested to conduct the assessment. During the session, which took place at the SERC, the practitioner planned to administer Raven's Colored Progressive Matrices, an attention test, and tablet-based speed tests. However, Aycan displayed significant reluctance and refused to complete the assessments with the practitioner. The practitioner recorded Aycan's opposition to the evaluation process in the assessment report:

> Aycan's cognitive development assessment report, October 17, 2024: "The child's initial reaction was to push the materials on the desk away with her hand, indicating her refusal. As the interaction continued, attempts were made to draw her attention to different materials. A tablet, in particular, usually breaks through the resistance of many children; however, this child's resistance persisted. [After the researcher left the room], the child repeatedly stated that she did not want to participate in the activities. She gravitated toward the toys in the classroom and ignored any prompts."

Consequently, the intended standardized cognitive assessments could not be conducted. Nonetheless, the practitioner engaged with Aycan for approximately 20 minutes in the SERC resource room. Based on these interactions and observations, the practitioner provided the following developmental insight:

> Aycan's cognitive development assessment report, October 17, 2024: "It was observed that the child is highly perceptive and can comfortably express her desires through language, gestures, and facial expressions; however, she exhibited high resistance and created an emotional barrier. Because she could not engage with the test administrations, no definitive inference could be made regarding her cognitive level."

Although a comprehensive standardized cognitive profile was unattainable, clinical observations validated prior findings concerning Aycan's communication abilities. Aycan was consistently characterized as a child who clearly and occasionally assertively conveyed her preferences and boundaries, primarily through gestures and facial expressions. In summary, the data addressing the second research question reveal a complex developmental profile. Observations indicated that Aycan demonstrated a high level of visual attention to facial expressions and environmental cues.

Despite her restricted spoken language input, she exhibited persistent, goal-directed behavior, robust play skills, and a quick adaptation to expressive communication strategies in a language-rich, supportive environment, such as the PGP. However, her reluctance during structured formal assessments and her primary reliance on non-verbal communication require continuous, specialized, and engaging educational interventions.

3.3. Specific Challenges Faced by the Family

The final research question aimed to identify the distinct daily obstacles faced by the family in raising a child with hearing loss, especially within the complex structure of a household with deaf parents. An examination of the triangulated data indicated that these challenges predominantly arise from intergenerational conflicts concerning communication methods and the significant necessity for organized parental education. A significant challenge within the family ecosystem is the disagreement over which communication modality Aycan should prioritize. The data indicate a transfer of communication ideologies across generations. Aycan's grandmother historically declined to learn or utilize sign language with her deaf daughter (Mrs. Ayşe), insisting on lip-reading to compel her adaptation to the hearing world. Aycan's maternal aunt elucidated this historical context:

> Interview with maternal aunt, lines 233–236: "Yes, she always read lips like that. For example, my mom [Aycan's grandmother] wouldn't use signs... she wasn't inclined towards it... she didn't want [Ayşe] to learn sign language so that she would read lips and improve herself... Because writing is different, not everyone can understand it, but by reading lips, she can understand even you."

Mrs. Ayşe, significantly influenced by her mother's methods, now anticipates that her daughter Aycan will communicate through spoken language and lip-reading, rather than exclusively using sign language. This approach creates a distinct point of conflict with Aycan's father, who relies exclusively on gestures and sign-based representations. Mrs. Ayşe articulated her discomfort and frustration regarding the father's incapacity to communicate verbally with Aycan:

> Interview, lines 493–494: "She doesn't understand [complex signs], she understands from gestures... I tell him [the father], 'Don't use gestures,' but he can't speak. What is he forced to do? He has to use gestures."

This ideological conflict over communication methods results in a fragmented linguistic environment for Aycan, posing a distinct challenge as she must navigate varying and occasionally contradictory expectations from her parents and extended family. Another significant challenge identified by the data is parents' insufficient pedagogical repertoire to facilitate children's language development. As a deaf mother raising a child with profound hearing loss, Mrs. Ayşe initially lacked targeted strategies to promote expressive language and often exhibited excessively controlling behaviors during play. Qualitative observations and reflective evaluations following the PGP revealed the mother's strong responsiveness to direct pedagogical support. Throughout the program, as educators modeled specific techniques, such as the "listen and say" strategy, researchers noted a positive shift in the mother's interaction style. She demonstrated a growing recognition of the value of these strategies and actively sought to increase her communication with Aycan. Furthermore, observations indicated a noticeable transition towards more autonomy-supportive parenting; the mother significantly reduced restrictive directives and increasingly allowed Aycan to navigate social interactions with her peers independently. However, alongside these communicative gains, the data also highlighted the family's ongoing challenges in managing structured daily routines and transitions. These instances point to the need for continuous, structured family education.

Ultimately, these findings reinforce that the primary focus of early intervention must extend beyond the child's audiological profile. It is equally essential to actively equip deaf parents with accessible resources, pedagogical methodologies, and emotional support required to cultivate an enriching communicative environment at home. In addition to the need for daily pedagogical strategies, another systemic challenge is ensuring the continuity of Aycan's early intervention. The family's sociocultural practices, particularly their relocation to the grandmother's village during the hazelnut season, cause an almost two-month disruption in Aycan's formal education at the SERC. This recurring disruption points out a serious deficit in family awareness regarding the absolute necessity of uninterrupted early intervention, particularly for a child with profound hearing loss growing up in a linguistically restricted environment. The director of the SERC highlighted the institution's proactive efforts to mitigate Aycan's social and linguistic isolation:

> Playgroup interview, November 20, 2024, lines 8–14: "We treat Aycan with particular sensitivity. Because her parents have hearing loss, she is exposed to spoken language much less frequently. For this reason, I specifically requested that the family bring Aycan to the SERC at convenient times [even outside of her scheduled lessons]. We created opportunities for her to interact with other peers waiting for their lessons in a suitable area."

The institution's efforts to address the child's linguistic deficiency innovatively are hindered by the family's traditional summer disruptions, highlighting a critical challenge: reconciling the family's sociocultural practices with the stringent requirements of special education. Confronting this challenge necessitates extensive family counseling and empowerment. Parents require focused assistance to cultivate a profound understanding that continuous, year-round educational engagement is essential, not optional, and must be harmonized with seasonal family responsibilities.

In summary, the findings regarding the third research question reveal that the family's challenges extend far beyond the child's audiological profile. Aycan's family faces a multifaceted array of challenges, primarily characterized by intergenerational disputes over preferred communication methods, a clear absence of home-based language-enhancement strategies, and sociocultural practices that significantly hinder the consistency of early intervention. The interconnected challenges underscore that enabling a deaf parent to raise a child with hearing loss demands more than mere access to a rehabilitation center; it requires thorough, culturally attuned family education and counseling. Equipping parents with effective communication tools and strategies, and cultivating a profound understanding of the necessity of continuous educational support, are vital measures to alleviate the child's linguistic isolation and optimize their developmental potential. Transforming this intricate family microsystem from a site of communicative discord into a supportive linguistic environment necessitates early intervention policies that acknowledge, honor, and actively promote the distinct sociocultural realities of diverse deaf households.

4. Discussion

This qualitative case study examined the communication dynamics, extensive developmental needs, and distinct family challenges of a child with hearing loss raised by Deaf parents. The results indicated a complex linguistic environment characterized by multimodal communication practices within the household. While initial observations highlighted Aycan's active engagement and quick adaptation to structured routines, it is crucial to interpret these short-term observations carefully. As noted in the findings, special education teachers initially perceived this rapid adaptation as "exceptional developmental potential." However, rather than signifying a miraculous four-day linguistic leap, this

perception likely stems from the educators' own pedagogical frameworks, their familiarity with normative developmental milestones, and their inherent positive expectations regarding the efficacy of the PGP intervention. The stark contrast between Aycan's prior pandemic-induced confinement and her sudden exposure to a highly interactive, supportive setting may have led the teachers to interpret her willingness to communicate as rapid linguistic acquisition. Instead of a dramatic acquisition of spoken words, a more realistic finding of this study is Aycan's ability to rapidly engage and utilize multimodal strategies, combining her existing gestural repertoire with emerging vocalizations, within just four days of participating in the PGP. This observation corresponds with existing literature on language acquisition in home settings characterized by restricted spoken language input (Hackworth et al., 2017; Turan, 2021). Research consistently indicates that children with hearing loss from households utilizing sign-based communication or gestures can show significant communicative responsiveness when introduced to immersive, language-rich settings, such as playgroups (Allen & Morere, 2020; Humphries et al., 2022; Mercure et al., 2025). While substantial improvements in communication can be achieved through intensive intervention (Roux & Stander, 2021), a four-day program primarily serves to highlight the child's readiness for structured learning rather than measurable linguistic milestones. As Lederberg et al. (2012) point out, initial delays in language development may persist for these children compared with peers who had continuous input from birth, underscoring the importance of providing Aycan with sustained, long-term, and multimodal educational support to help her communicate effectively.

Family dynamics make it difficult to realize this potential. The data highlighted profound intergenerational tension regarding communication modalities. The grandmother's insistence on oralism and lip-reading created a highly fragmented linguistic environment for the child, in contrast to the father's reliance on gestures and the mother's conflicting expectations. This finding illustrates wider sociolinguistic issues identified in the literature, indicating that intergenerational conflict frequently occurs in Deaf families when grandparents support oralism while parents favor sign language communication (Kanto et al., 2013; van der Zee & Dirks, 2022). Such inconsistent or conflicting communication modalities within the family system can create significant confusion and stress for the child. Kanto et al. (2013) asserted that when children are compelled to favor one modality over another, it impedes intergenerational comprehension and can adversely impact family cohesion and the child's sociolinguistic identity.

This study also found that the family's sociocultural routine, such as relocating to the village for two months during hazelnut season, presented a practical barrier to Aycan's educational continuity. This finding strongly suggests that continuity in early intervention supports the optimal development of children with hearing loss (Holzinger et al., 2022; Yoshinaga-Itano, 2020). Interruptions due to seasonal relocations or sociocultural practices can disrupt the momentum of language acquisition. Brief interruptions during critical developmental phases can pose challenges to expressive communication, pragmatic abilities, and social-emotional growth (Yoshinaga-Itano et al., 2020). Longitudinal studies indicate that enriched home language environments can mitigate the adverse effects of interrupted interventions (Dickerson et al., 2025; Holzinger et al., 2022). However, families facing systemic communication barriers, such as Aycan's, may find it more difficult to navigate these service disruptions independently. Given Aycan's environment of restricted spoken language input, these gaps in formal educational support underscore the urgent need for flexible, continuous intervention models tailored to such specific family contexts.

Finally, these findings emphasize that a child-centered approach alone cannot address the complex needs of a child with hearing loss born to Deaf parents. It requires a holistic, family-centered

approach that provides individualized support (Gomes et al., 2025), respects the family's unique linguistic landscape (van der Zee & Dirks, 2022), and actively equips parents with accessible strategies necessary to maintain a continuous and enriching communicative environment (Hassanzadeh, 2012).

5. Conclusion

This qualitative case study highlights the profound complexities of raising a child with hearing loss in a Deaf family context. According to educators at both the PGP and SERC, Aycan can further enhance her multimodal communication by systematically attending educational programs that address her specific linguistic and developmental needs. However, for such consistent progress to occur, it is recommended that she be placed in inclusive environments where she can engage in play and social interaction tailored to her communicative requirements. While Aycan occasionally accesses these environments, her systematic participation is hindered by various contextual challenges. These challenges include intergenerational communication differences, parents' need for accessible pedagogical strategies, and sociocultural routines that disrupt educational continuity. Owing to communication issues and the father's limited participation in SERC sessions and interviews, this study was unable to obtain comprehensive data from him. Future research should strive to incorporate inclusive methodologies to capture the perspectives of all primary caregivers.

These findings indicate that concentrating exclusively on a child's specific educational or audiological requirements is inadequate. Interventions must prioritize timely, consistent access to a rich linguistic environment and provide culturally sensitive counseling to help families navigate intergenerational tensions. Furthermore, professionals must proactively address sociocultural barriers by developing flexible support mechanisms to ensure the continuity of interventions. Ultimately, adopting a holistic, family-centered approach is essential; empowering deaf parents with actionable pedagogical tools is as critical as the direct therapy provided to the child. Given these profound ecological needs, there is an urgent need to revise early intervention policies in Türkiye. Systematic playgroup programs tailored specifically for the 0–3 age group should be expanded and standardized nationwide. Additionally, SERCs need to move beyond traditional models that focus solely on the child and instead integrate structured, family-centered educational programs. Government-funded special education policies should actively support and empower parents, especially those with diverse communicative or physical needs, transforming them into skilled facilitators of their child's linguistic and cognitive development in naturalistic home environments.

6. Declarations

6.1. Author Contributions (CRediT)

The first and second authors contributed equally to the study's conception and design, data analysis, and the writing and critical revision of the manuscript. The first author conducted the primary data collection (observations and interviews), and the primary contact is the person who is introduced to the child and their family and maintains active interaction throughout the research. Both authors read and approved the final manuscript.

6.2. Conflict of Interest

The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

6.3. Funding Statement

The authors declare that the study received no funding.

6.4. Data Availability Statement

Research data are not shared publicly due to ethical constraints and participant confidentiality. Data supporting the findings of this study are available within the article.

6.5. Ethics Approval

Ethical approval was obtained from the Ordu University Ethics Committee (Decision No. 2024-151, October 25, 2024).

6.6. Use of Artificial Intelligence (AI) Tools

During the preparation of this work, we used Grammarly from November 2025 to February 2026 to edit manuscripts. After using this tool/service, we reviewed and edited the content as needed and take full responsibility for the publication's content.

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