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Evaluation of BİLSEM teachers' use of digital tools according to teachers' opinions[1]

Yasemin Gözüküçük*[2] and Birsen Bağçeci[2]

[2] Educational Sciences, Faculty of Education, Gaziantep University, Gaziantep, Türkiye.

Abstract

This study aims to examine the role of digital tools in the educational process, teachers' perspectives on these tools, and the challenges they encounter. Additionally, it seeks to contribute to the identification of teaching strategies and the development of teacher training programs. The study adopts a phenomenological design and includes interviews with 20 teachers from various disciplines working at five different Science and Art Centers (Bilsem) in Gaziantep. Participants were selected using the criterion sampling method, and data were collected through a semi-structured interview form developed based on expert opinions. The collected data were analyzed using content analysis with the MaxQDA Analytics Pro software. The results indicate that in order for teachers working at Bilsem to use digital tools more effectively in their lessons and projects, it is essential to improve existing teaching methods and enhance training programs. These improvements should focus on integrating practical applications of digital tools into pedagogical practices, providing continuous professional development opportunities, and offering hands-on workshops tailored to teachers' specific subject areas. Moreover, fostering a supportive institutional environment that encourages experimentation and collaboration among educators can significantly contribute to the effective integration of digital technologies in teaching and learning processes.

Keywords: Science and art center, teachers in science and art center, technology in education.

Introduction

Technological tools have become indispensable factss of the 21st century with the acceleration of globalization in today's world. Scientific and technological developments are transforming social, economic, and cultural dynamics, and the widespread use of information and communication technologies makes these tools a fundamental part of daily life (Aktürk & Delen, 2020). While the rapid development of technology leads to radical changes in social interaction and communication styles, it creates far-reaching transformations at the individual and institutional level. In the globalizing world, technology has not only been shaped in line with social needs; it has also become an element seeking answers to the questions of how much we can develop knowledge and creativity and how good we can be in a competitive environment (Kaynar, 2019). As a result of these, the proliferation of digital technologies has also accelerated the flow of information, making access to information on a global scale more democratic.

Individuals develop their cognitive capacities by acquiring knowledge through education from birth. Education is a multifaceted process that supports the cognitive, social and emotional development of

[1] Gaziantep University - Lifelong Learning Thesis Master's Degree

*Corresponding Author: yasemingozukucuk7@gmail.com

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individuals. This process, which includes formal and informal learning experiences, contributes to the development of lifelong learning skills. Education can also be developed as a process through which an individual acquires the skills, interests and styles that play a significant role in the society they live in. This process involves a selective and organized environment and school activities, a structure formed by the integration of the individual and their social life. In other words, education is not merely the transfer of knowledge; it also provides a dynamic social presentation that enables the individual to develop themselves by interacting with social life (Demirel & Ün, 1987). All of these things can be provided with the quality education. The quality of education depends on factors such as learning environments, up-to-dateness of curricula and variety of methods. An effective education system also aims to improve individuals' reasoning, problem-solving and creative thinking skills. Education has also begun to transform itself with the developing technology and needs technological tools and equipment to achieve the targeted gains. As stated by Al Rawashdeh et al. (2021), supporting educational contents with animations, audio and videos enables students to have a more systematic and effective learning experience. In the light of all this information; teachers are using technology to support students' potential, enable individualized instruction, and evaluate the effectiveness of different methods (Bransford, Brown & Cocking, 2000; Karsenti & Bugmann, 2018; Papert, 1980).

The use of technology in education encourages active participation in learning by increasing student motivation. Digital tools make students' learning experiences more interesting and interactive while allowing teachers to guide their students more effectively by improving their digital literacy. These tools specifically support student-centered and individualized learning processes. While in traditional classrooms, teachers struggle to focus on individual needs, technological tools make it easier for students to learn at their own pace and according to their preferences. This change makes students' learning processes more customized and efficient. A study by Deng, Wu, Chen, and Peng (2020) demonstrated that digital teaching tools have the potential to enhance students' perceptions. Similarly, Auttawutikul, Wiwitkunkasem, and Smith (2014) noted that digital teaching tools play a significant role in helping students demonstrate their creativity. Blanco-Herrera et al. (2019) emphasized that such tools enhance students' creativity and problem-solving skills and offer numerous opportunities in the teaching process.

Historically, the use of technology in education has been increasing since the 1920s; in the 1930s, overhead projectors began to be used and in the 1950s, tools such as headphones and photocopiers began to be used. In Türkiye, the integration of technology, which started with radio and television in the 1970s, continues today with the internet, computers, smartphones and other digital tools. These developments are creating a more accessible and interactive environment in education and transforming teaching methods. Research shows that teachers often find digital tools useful but are also aware of their negative impact. Teacher candidates mostly prefer smart boards and mathematics software for technology integration in education. However, it is important to provide a more balanced and effective training process, considering the potential negative effects of technology. The contribution of digital tools to students' academic achievement has been observed and the importance of instructional design for the effective use of technological teaching tools has been emphasized. The successful integration of digital tools in education becomes more efficient with the combined use of visual and verbal elements. Research on the role of technology in education shows that digital tools improve success and learning experience (Yıldırım & Akyüz, 2024). Educators should include asynchronous activities and develop students' individual learning skills to provide differentiated and enriched learning experiences. Considering individual differences in education, the use of technology

helps to create more effective learning environments (Dickinson & Bass, 2020). The change in the definitions of superior intelligence around the world is parallel to the evolution of intelligence from a one-dimensional to a multi-dimensional structure. This indicates that intelligence is considered from a broader perspective and that the value of individuals' different abilities should be emphasized (Anderson & Krathwohl, 2000). These improvements also effected our Ministry of National Education.

Over time, the Ministry of National Education adopted this change and started to use the term “special talents” instead of “giftedness” and defined individuals with speacial talents as “people who show high performance compared to their peers and are determined by experts” (MEB, 1991). The American National Association for Gifted Children (NAGC) defines gifted individuals as those who perform or have high potential in one or more areas. These areas include different abilities such as specialized academic abilities, general intellectual skills, creativity, leadership, and visual and applied arts.The education of gifted children is critical for the future of the country and these children need differentiated programs tailored to their individual needs. In Turkey, this education is provided through Science and Art Centers (Bilsem) and plays a supporting role in formal education (Delibay, 2017). The education programs implemented in Bilsem differ from the general education programs and focus on developing the skills of the students. In addition to the lessons, teachers develop students' analytical, critical and creative thinking skills and increase their social and communication competencies through projects such as TUBITAK, Teknofest and eTwinning. Schools like Bilsem have been significantly affected by technology in recent years, and digital tools can be integrated into sports lessons and project planning at Bilsem. Siegle (2019) states that modern technologies play an important role in unlocking the potential of gifted students and removing learning barriers. The effective use of technology in the education of gifted students increases success and facilitates learning processes. While Öngöz and Aksoy (2015) state that the high-level use of technology is important in education with gifted students. Çalışkan (2017) emphasizes that technology increases the motivation of these students and provides permanent learning. Digital tools contribute to the development of gifted individuals and the effective use of technology in education positively affects success (Pyryt, 2009; Shavinina, 2009; Siegle, 2005).

Rapidly evolving technology and scientific advances have made individual differences more pronounced, which has alienated teachers from traditional methods. In particular, Bilsem teachers have sought more modern education methods for gifted students who learn faster and are more prone to technology than their peers. In order for gifted students to realize their potential, differentiated education and special supports should be offered beyond standard curricula (Kazu & Şenol, 2012). The integration of digital tools in the Science and Art Centers (BILSEM), which were created for gifted students, contributes to the development of students' analytical thinking, problem solving and creativity skills. While coding and robotic applications strengthen the ability to think algorithmically, virtual and augmented reality technologies help to concretize abstract concepts. Bilsem teachers have observed that students are more active and successful in lessons where technological tools are used. Traditional educational environments can cause gifted students to lose their talents and experience psychological difficulties (Colengelo, 2002). For this reason, the training of teachers who use technology effectively and follow innovations is of great importance in order to raise individuals with the skills required by the age (Kırındı & Durmuş, 2019; Yiğit-Koyunkaya & Tataroğlu-Taşdan, 2019). Today, it is not possible to design a technology-independent process in education. Therefore, it has become a professional necessity for teachers to be able to use technology effectively. In digitalized educational environments, it is a critical requirement for teachers to increase their professional competencies and align their pedagogical approaches with technological tools. Teachers' increasing technology literacy

is an important factor in terms of the efficiency of the education system. The success of technology integration in education is directly related to the professional development opportunities that will be offered to teachers. Therefore, improving teachers' technology usage skills should be considered as a strategic priority to improve the quality of education.

The purpose of this study is to evaluate the use of digital tools by Science and Art Center (BILSEM) teachers based on their own perspectives. Rapidly developing technology and scientific advancements have made individual differences more pronounced, leading many teachers to distance themselves from traditional methods applied uniformly to every student. BILSEM teachers, particularly those working with gifted students, have sought more modern methods and techniques for their students, who learn faster and more easily than their peers and are more engaged with technology. In order for gifted children to realize their potential and contribute to society, they need to be supported with differentiated educational programs and specialized services beyond the standard school curriculum (Kazu & Şenol, 2012). Bilsem teachers have observed that their students are more active and successful in classes where technological tools are used. Bilsem teachers observed that their students were more active and successful in classes where technological tools were used. Learning gifted students in traditional educational environments causes their abilities to diminish over time and leads to psychological problems; thus, these individuals, who could contribute to the development of their society and the world, become ineffective and unhappy (Colengelo, 2002). In this context, to be successful in an educational process that aims to develop individuals with the skills required by the current era, it is crucial to train teachers who can effectively use existing technology and keep up with innovations and include them in the educational process (Kırındı & Durmuş, 2019; Yiğit-Koyunkaya & Tataroğlu-Taşdan, 2019). In this context, this study aims to uncover and evaluate the role of digital tools in the education process, teachers' thoughts, challenges, and opinions regarding these tools. It also aims to contribute to the identification of strategies that can improve teachers' teaching methods in their classes and projects, as well as the development of teacher education programs.

Method

Design

In this study, a phenomenological approach was adopted to delve deeply into the participants' experiences and perspectives. Qualitative research deals with the research problem by interpreting it from perspectives from various disciplines and analyzes events in line with the meanings that individuals attribute to these events (Altunışık, Coşkun & Yıldırım, 2019). Phenomenology seeks to reveal the common meanings of the experiences of individuals who experience a particular phenomenon deeply (Creswell, 2013). This research aims to examine the opinions of Bilsem teachers on the use of digital tools.

Participants and procedure

In the study which was carried out voluntarily with 20 teachers working in 5 different Science and Art Centers in Gaziantep, the education levels of the participants were diversified at undergraduate, graduate and doctoral levels. Care was taken to include 10 female and 10 male teachers among the participants. The study was approved by Gaziantep University Ethics Committee for Scientific Research and Publications in Social and Human Sciences. Teachers were selected using the criterion sampling technique, which allows the researcher to select participants who fit certain criteria (Merriam, 2009). The interviews were conducted by informing the participants about the purpose of the research and

providing a guarantee of confidentiality. 45-minute interviews were conducted with each participant. The data were reported with the abbreviation “T”, respecting the confidentiality of the participants. The participant profile table, in which the information requested from the participants is compiled, is given in Table 1.

Table 1 Participant profile table

Participant	Age	Gender	Education Status	Branch	In Bilsem Time Worked
T1	31-35	Woman	Doctorate	Math Teacher	6-10
T2	41-45	Male	Doctorate	Classroom Teacher	6-10
T3	41-45	Woman	Master	English Teacher	1-5
T4	36-40	Male	License	Science	1-5
T5	31-35	Woman	Master	Chemistry Teacher	1-5
T6	31-35	Male	License	Information Technologies	6-10
T7	41-45	Male	Doctorate	Turkish Teacher	6-10
T8	41-45	Male	Master	Music Teacher	6-10
T9	41-45	Woman	License	Visual Arts Teacher	6-10
T10	36-40	Woman	Master	Biology Teacher	1-5
T11	25-30	Woman	Master	Technology & Design	1-5
T12	31-35	Male	Doctorate	Math Teacher	6-10
T13	31-35	Woman	Master	English Teacher	1-5
T14	31-35	Male	License	Classroom Teacher	1-5
T15	25-30	Woman	License	Turkish Teacher	1-5
T16	31-35	Male	Master	Biology Teacher	1-5
T17	36-40	Woman	Doctorate	Chemistry Teacher	6-10
T18	31-35	Male	Master	Science	1-5
T19	31-35	Woman	Master	Visual Arts Teacher	1-5
T20	36-40	Male	License	Music Teacher	1-5

Measures

This study aims to evaluate Bilsem teachers' approaches to using digital tools based on their opinions. Therefore, the interview technique, a qualitative research technique, was used. Interviews are a communication process aimed at obtaining information (Berg & Lune, 2015). Interviewing is an effective method to deeply understand individuals' feelings, thoughts, and experiences (Sevencan & Çilingiroğlu, 2007). Data were collected through semi-structured face-to-face interviews with 20 teachers from various disciplines at five different Science and Art Centers in Gaziantep province, each conducted at a predetermined timeframe. Each one-on-one interview, conducted at different times, lasted 45 minutes. Interview questions were developed based on literature reviews and research, expert opinions, and discussions with the teacher's advisor. The opinions of three experts were consulted during the preparation of the interview form and questions. Based on this feedback, three questions were modified and rewritten. A pilot study was conducted with five teachers from different disciplines at a Science and Arts Center, and based on the feedback received, the teacher interview form was revised, and the data collection tool was prepared for the actual study. These data from the pilot study were not used as findings from the actual study. The teacher interview form included a total of 20 open-ended questions, each designed to elicit teachers' opinions on specific, purposeful topics. The data obtained was verified one-on-one with the participating teachers immediately following the interviews and incorporated into the analysis process.

Data analysis

Content analysis technique was used in the data analysis process. The data obtained through semi-structured interviews were converted into text and re-examined. Content analysis aims to derive codes from events that are frequently repeated or highlighted by participants, and to transform these codes

into categories and themes. The data were analyzed and interpreted through this systematic process (Bengtsson, 2016; Crabtree & Miller, 1999; Merriam & Grenier, 2019). Content analysis allows for the examination of oral and written materials objectively. The analysis went through four stages: 1) Coding of the data, 2) Identification of themes, 3) Organization of codes and themes, 4) Identification and interpretation of findings.

During the interviews, a meticulous transcription process was carried out to ensure the accuracy of the participants' statements (Halcomb & Davidson, 2006). The obtained data were transferred to the MaxQDA Analytics Pro software, and the coding process was carried out in line with the research questions. Coding was carried out with an exploratory and deductive approach, and themes were predetermined based on the theoretical framework (Patton, 2002). During coding, implicit meanings and contextual elements were taken into account, as well as participants' expressions on the surface (Braun & Clarke, 2006). Frequency analyses determined the frequency of the codes and thematic patterns, and the results were presented quantitatively.

Validity, reliability, and ethical considerations

In qualitative research, validity has two meanings as internal and external validity (Kaya, 2022). In this study, in order to increase internal validity, the data obtained from the interviews with the teachers were presented to the teachers and confirmed: “Do these comments reflect your thoughts correctly?” External validity was strengthened by quoting teachers' opinions and collecting data with purposive sampling technique. The methods, techniques, interview questions and findings used in the research were shaped by expert opinions. In order to increase external validity, detailed information about the data collection and analysis process was given to the participants and participants from different branches, grade levels and age groups were selected.

In order to increase the reliability of the research, coding and interpretation processes were shared and verified with the participants. Reliability means that the same results are obtained if the research is repeated (Merriam, 1998). In this study, the codings were made by two independent researchers, compared and finalized with expert opinions. In addition, the verification process based on the model of Miles and Huberman (1994) was applied. The consensus rate among different coders is an important criterion for assessing reliability in qualitative research (Fidan & Öztürk, 2015). A consensus of at least 80% among coders is the expected level of reliability for qualitative data analysis (Miles & Huberman, 1994). The consensus-based development program is Reliability = Consensus / (Consensus + Disagreement). According to this equation, Reliability = 121 / (121+25) was set to 83.44%. Therefore, due to the success indicator of the resulting codes exceeding 80%, mathematical qualitative data analysis has been proven reliable.

Findings

Within the scope of the research, four main themes were determined based on the data obtained from the interviews with the participants: “Digital Tool Use Experiences”, “Contribution of Digital Tools to Education”, “Difficulties in Using Digital Tools” and “Suggestions for Digital Tool Use”. There are different categories under these themes. The table of themes and categories is in Table 2.

Table 2 Themes and categories identified within the scope of the research

Themes	Categories
Digital Tool Use Experiences	Digital Tool Usage Status
	Digital Tools Used
	Motivations for Preferring Digital Tools

	Processes Using Digital Tools Projects and Events Carried Out with Digital Tools Teachers' Perceptions of Competence in the Use of Digital Tools Teachers' Training Status for the Use of Digital Tools
The Contribution of Digital Tools to Education	Students' Contribution to the Learning Process The Place of Digital Tools in the Education Program
Challenges in Using Digital Tools	Problems Experienced While Using Digital Tools Solutions to the Problems Experienced While Using Digital Tools Get technical support for issues Time Management Challenges in Planning and Implementation Difficulties Due to Students' Lack of Interest in Digital Tools Balance Challenges Between Digital Tool and Face-to-Face Education
Recommendations for the Use of Digital Tools	Recommendations for the Effective Use of Digital Tools Recommendations for Increasing the Use of Digital Tools

"Digital Tool Usage Experiences" Theme

According to the data obtained under the theme of "Digital Tool Usage Experiences", two codes were found in the "Digital Tool Usage Status" category. The "Partially Using" code is coded 6 times, and the "Yes, Using" code is coded 14 times. The most common digital tools are Kahoot, Padlet, and Quizizz. Among the reasons why digital tools are preferred, the most common answer is that the lessons become interesting. It has been determined that these tools are generally used in narrative and evaluation processes, especially in TUBITAK projects. A participant (T7) said, "I *use it in Tübitak2204 A/B projects,*" and stated that he used digital tools in these projects. It has been observed that teachers are open to development in the use of digital tools and find themselves sufficient. In addition, a participant (T8) stated that teachers received training on digital tools and that they should receive more training on this subject, "*I find it sufficient, but I think that teachers should be trained more on this issue because the use of digital tools is increasingly important.*" he said—the table of "Categories and Codes of "Digital Tool Usage of Experiences in Table 3.

Table 3 Frequency distribution table of the codes related to the theme of "Digital Tool Usage Experiences"

Categories and Codes	*f*
Digital Tool Usage Status	
Yes, it uses	14
Partially Uses	6
Digital Tools Used	
Kahoot!	5
Padlet	5
Quizizz	5
Google Slides	4
Canva	3
Trello	3
Web2.0 Tools	3
Smart Board	2
Edmodo	2
GeoGebra	2
Google Docs	2
Google Forms	2
Jamboard	2
Mentimeter	2
PowerPoint	2
Prezi	2
Web3.0 Tools	1
Tinkercad	1
Fusion 360	1
Computer	1
Actionbound	1
cospace.edu	1
Class Dojo	1

Desmos	1
Google Classroom	1
Zoom	1
Motivations for Preferring Digital Tools	
Making Lessons Interesting	10
Students Being More Active in Lessons	7
Students' Interest in Digital Tools	6
Acceleration of Learning	5
Facilitating Learning	4
Quick Feedback	4
Being a Necessity of the Age	3
Appealing to Multiple Senses	3
Visualization of Abstract Concepts	2
Reinforcing Theoretical Knowledge	2
Making Lessons Fun	2
Making Lessons Fluent	2
Developing Students' Creativity	1
Students' Aptitude for Digital Tools	1
Processes Using Digital Tools	
Usage in the Narrative Process	19
Usage in the Evaluation Process	19
Usage in the Preparation Process	15
Usage in the Feedback Process	1
Projects and Events Carried Out with Digital Tools	
Tübitak Projects	12
Applied Courses and Activities	6
eTwinning Projects	6
Activities and Projects Carried Out by Private Schools	3
Erasmus Projects	2
Teknofest	2
Not Performing Special Projects or Events	2
Project Studies	1
Workshops	1
Poster Works	1
Creating a Virtual Classroom Environment	1
Virtual Reality Events	1
Preparing Math-Based Games	1
Teachers' Perceptions of Competence in the Use of Digital Tools	
Being Open to Development	11
Finding Yourself Sufficient	11
Finding Yourself Partially Sufficient	9
Keeping Up with Innovations	2
Teachers' Training Status for Digital Tool Use	
Receiving Various Trainings	19
The Need for Further Training	2
Individual Learning	1
Not Receiving Any Education	1

I can share materials appropriate to students' level of knowledge using platforms like Google Docs and Classroom. I enrich my teaching by using both visual and audio materials in presentations prepared with tools like Google Slides. I prepare visually rich presentations using platforms like Canva (T2).

> I use it mostly during lectures. Explanations with visuals are more understandable and faster to convey (T10).
>
> I use digital tools extensively in eTwinning projects (T3).
>
> I use them in Teknofest projects (T12).
>
> I've been using digital tools in my classes since 2014. Therefore, I consider myself competent in this area (T16).
>
> Yes. I received 4005 project training on Steam and digital tool use (T4)

“The Contribution of Digital Tools to Education” Theme

When the findings of the theme were examined, two categories emerged: “Students' Contribution to

the Learning Process" and "The Place of Digital Tools in the Education Program." Regarding the contribution of digital tools to the learning process of students, the majority of the participating teachers stated that these tools have positive effects on cooperation and individualized education among students. One participant (T4) said, "*It definitely offers the opportunity for collaborative learning. That is what I love most about digital tools. We completed many studies by meeting with my students in a virtual environment in online meeting tools. Some applications, such as Trello padlets, facilitate the distribution of tasks and allow students to learn from each other. By interacting with each other with these tools, students can learn more easily regardless of place and place* and emphasized the contribution of digital tools to collaborative learning." Only one participant stated that digital tools contributed negatively to student motivation. These findings reveal that the contribution of digital tools to the learning process is positive. Under the category of "The Place of Digital Tools in the Education Program", most of the participating teachers stated that digital tools should be included in the education programs. However, it is also understood that teachers' demands for the inclusion of digital tools in the educational process and programs should not be ignored. A participant (T3) said, "Educational *programs should encourage teachers to use digital tools. Before the discussion of how much should be included in the curriculum, if the teachers are trained on this subject and we are provided with sufficient equipment to use these tools, the teacher can decide on the dose of this* and state that digital tools should be included in education programs." The table of "Contribution of Digital Tools to Education" is in Table 4.

Table 4 Frequency distribution table of codes related to the theme "Contribution of Digital Tools to Education"

Categories and Codes	*f*
Students' Contribution to the Learning Process	
Positive Contribution to the Learning Process	22
Positive Contribution to Cooperation Between Students	22
Positive Contribution to Individualized Education	22
Positive Contribution to Student Motivation	21
Positive Contribution of Gifted Students to the Learning Process	20
Negative Contribution to Student Motivation	1
The Place of Digital Tools in the Education Program	
Inclusion of Digital Tools in the Education Program	17
Training of Teachers on Digital Tools	2
Partial Inclusion in the Training Program	1
Not Included in the Program Due to Inequality of Opportunity	1
Leaving the Necessary Support and Training to the Teachers' Decision	1

> Gifted students are open to learning, but they are also open to different learning styles. I believe using digital tools in the classroom is an opportunity to meet their learning desires and leverage their open perceptions (T18).
>
> Yes, they become more active and work harder. When I use gamification elements (points, badges, leaderboards), I see students become more engaged in the learning process. This increases their sense of competition and boosts student motivation. It encourages them to participate more actively in lessons and projects (T19).
>
> Yes, I do, because in the 21st century, in the digital age, students learn faster, easier, more effectively, and more consistently with technological tools. Because we can teach abstract topics in concrete and more detailed ways thanks to these tools, students are also stimulated by their curiosity and interest (T10).
>
> Digital tools allow for the implementation of innovative teaching methods. Students can learn more effectively with content that appeals to different learning styles (T13).

"Difficulties Encountered in Digital Tool Use" theme

When the findings related to the theme were examined, 11 codes were determined under the category of "Problems Experienced While Using Digital Tools" in line with the answers given to the relevant interview questions. Internet problems and lack of hardware have come to the fore as the most common problems. A participant (T3) said, "*Infrastructure and technical problems. for example, the internet does not pull. If you say you know in the center of the city, your student cannot connect with wifi. You can't use a phone or tablet. At most, you take each of them out on the board one by one and complete the activity on the board. This is really a waste of time and demotivation* and expressed the problems of lack of internet and hardware." 11 codes were discovered in the category of "Solutions to Problems Experienced While Using Digital Tools" and among the most coded ones were "Getting Colleague Support" (10 times), "Individual Solution of Problems" and "Individual Internet Sharing" (6 times). A participant (T15) said, "We *are trying to solve it ourselves with our own means*." In the category of "Getting Technical Support for Problems", 3 codes were determined and the "Sometimes Getting Support" code was coded 11 times. In the category of "Difficulties in Time Management in Planning and Implementation", 7 codes were discovered, the most frequently coded was the "Long Time to Digital Material Preparation" code (11 times). In the category of "Difficulties Due to Students' Lack of Interest in Digital Tools", 5 codes were determined and the most coded codes were "Students Not Experiencing Apathy" (9 times) and "Students Having Difficulty in Learning" (7 times). A participant (T7) said, "*Some students may lose interest because they have difficulty learning digital tools* and stated that students have difficulties with digital tools." 11 codes were discovered in the category of "Balance Challenges Between Digital Tools and Face-to-Face Education" and the most frequently coded code was "Difficulties of Transition from Digital Methods to Classical Methods" (7 times). A participant (T16) said, "*When they switch to traditional methods, they get depressed but unfortunately they are not always digital. Sometimes traditional methods are also necessary.*" The table of "Difficulties Encountered in the Usage of Digital Tools" is in Table 5.

Table 5 Frequency distribution table of codes related to the theme "Difficulties Encountered in the Usage of Digital Tools"

Categories and Codes	*f*
Problems Experienced While Using Digital Tools	
Internet Problems	15
Lack of Hardware	9
Software Errors and Inadequacies	4
Technical Issues	3
Learning New Apps	2
Inadequacies in Using Hardware	2
Data Loss	1
Data Security	1
Power Outages	1
Not Having Frequent Problems	1
Password Management	1
Solutions to Problems Experienced While Using Digital Tools	
Getting Peer Support	10
Individual Solution of Problems	6
Individual Internet Sharing	6
Getting Technical Support	3
Addressing Hardware Deficiencies with Group Work	1
Obtaining Student Support	1
Trial and Error	1
Using Open Source Educational Materials	1
Failure to Implement a Solution Strategy	1
Peer Education	1

Solving the Problem with the Respondent	1
Getting Technical Support for Problems	
Sometimes Getting Support	11
Insufficient Technical Support	7
Sufficient Technical Support	5
Difficulties in Time Management in Planning and Execution	
Long Time to Prepare Digital Materials	11
Time Loss in Implementation	1
Both Processes Take Time	1
Students Learn Late During the Usage Process	1
Lack of Time Management Difficulty	1
Technical Glitches Cause Time Loss	1
Unprepared Transition to Implementation	1
Difficulties Due to Students' Lack of Interest in Digital Tools	
Students' Lack of Interest	9
Students' Difficulty in Learning	7
Disinterest Due to Students' Dislike of Certain Tools	1
Students' Difficulty in Adapting	1
Students' Desire for Traditional Methods	1
Balance Difficulties Between Digital Tools and Face-to-Face Education	
Difficulties of Transitioning from Digital to Traditional Methods	7
Eliminating Balance Issues	4
Tool Complexity	2
Presence of Distracting Content in Digital Tools	2
Difficulties Experienced by Students in Adaptation	1
Understandability Difficulties in Initial Application	1
Insufficient Hardware	1
Insufficient Technical Staff	1
Observation Difficulties in Distance Education	1
Measuring Digital Tool Effectiveness	1
Student Speed Differences in the Digital Environment	1

Concerns about data security and privacy can prevent users from using digital tools (T11).

Software errors, difficulty opening the app, or sometimes it does not open at all (T10).

I can find it challenging when students have never held a digital device before or have not spent enough time with it, yet still lack confidence in using it (T1).

I usually bring tablets from other classes or have group work done (T15).

We have established IT support teams at schools, ensuring users receive immediate assistance. These teams can quickly resolve technical issues (T12).

I try to get support from my colleagues (T9).

I use my own phone's internet (T14).

We do not have a technical support person (T4).

"Recommendations for the Use of Digital Tools" theme

In the category of "Recommendations for the Effective Use of Digital Tools", 10 codes were determined. The most coded codes were "Educational Applications" (f=9), "Increasing the Necessary Equipment" and "Development of Internet Infrastructure" (f=8) and "Development of Internet Infrastructure" (f=8) came to the fore. A participant (T13) said, "*The school's internet connection should be strengthened so that everyone has access to the tools.*" and emphasized the need to improve the internet infrastructure. "In the category of "Suggestions for Increasing the Use of Digital Tools", 10 codes were discovered, and the most coded codes were "Providing Equipment" (f=12) and "Increasing Trainings" (f=9) and "Increasing Technical Support" (f=8) come to the fore. A participant (T11) said, "*Trainings on how to use digital tools should be organized for teachers and students. Students should be taught about safe and effective behaviours on digital platforms,*" and stated that training should be increased. The table of "Recommendations for the Use of Digital Tools is in Table 6.

Table 6 Frequency distribution table of codes related to the theme “Recommendations for the Use of Digital Tools”

Categories and Codes	*f*
Recommendations for Effective Use of Digital Tools	
Educational Applications	9
Increasing Necessary Hardware	8
Developing Internet Infrastructure	8
Providing Technical Support	5
Integrating Digital Tools into the Curriculum	4
Improving Existing Hardware	2
Digital Work Practices and Evaluation	1
Each Institution Has an IT Teacher	1
More Frequent Use by Teachers	1
Increasing Institutional Resources	1
Suggestions for Increasing the Use of Digital Tools	
Providing Hardware	12
Increasing Training	9
Increasing Technical Support	8
Resolving Internet Infrastructure Deficiencies	5
Providing Software	2
Organizing Events	1
Promoting Tools	1
Providing Training to Parents	1
Updating Existing Hardware	1
Providing Necessary Hardware by the Government	1

> Hardware should be strengthened to ensure everyone's access to tools. Students should be provided with the necessary digital devices and given equal access opportunities (T11).
>
> Training should be organized not only for teachers but also for parents. At the very least, to raise awareness on this issue and encourage students at home (T3).
>
> Older models of digital devices should be replaced with new, updated ones (T2).
>
> Robotic materials, 3D pens, etc., should be sent to institutions free of charge by the government, just like textbooks (T1).
>
> Technical support should be provided. Institutions must have IT instructors (T9).
>
> After hardware deficiencies are addressed, teachers can be trained on the use of digital tools and even on resolving technical issues (T13).

Limitations and future directions

This research was limited to 20 teachers working at five different Science and Art Centers in Gaziantep province during the 2024-2025 academic year and data obtained from these teachers using data collection tools. This study should be conducted both in Bilsems in different provinces and with more teachers from different branches. Comparative studies should be conducted to examine and evaluate the impact of digital tools on students of different ages, levels, socioeconomic backgrounds, and those with special educational needs. This will also be beneficial for the development of inclusive education policies. Research should be conducted to evaluate the impact and benefits of training programs designed to enhance teachers' digital competencies. These studies will support the development and implementation of in-service training programs. Experimental studies should be conducted on the use of virtual reality, augmented reality, and artificial intelligence technologies in educational environments. These studies can reveal the benefits and limitations of incorporating these technologies into learning processes. Interdisciplinary research examining the use of educational technologies from the perspectives of pedagogy, psychology, and information science should be encouraged. This is essential to better understand the multidimensional nature of technology use. Studies should be conducted to examine the impact of inequalities in access to digital tools on educational outcomes. These studies can contribute to the development of policies aimed at ensuring

equal opportunities in education. Studies examining the effectiveness of new measurement and evaluation methods in environments where digital tools are used are needed. This could help facilitate more accurate and comprehensive assessments of student performance in technology-supported learning environments.

Conclusion

The theme of “Digital Tool Use Experiences” identified in the study reveals how teachers experience and perceive digital tools. The findings show that teachers are largely active in using digital tools, but the “Partially Using” code is also included in a significant proportion. This situation points to the importance of continuity and adequacy in the use of technology. Under the category of “Digital Tool Usage Status”, it was concluded that the participating teachers mostly used digital tools in their lessons and project work. Under the “Digital Tool Use” category, it was concluded that participating teachers frequently used digital tools in their lessons and projects. This result is supported by other studies in the literatüre (Günar ve Kaya, 2023; Selwyn, 2016). In addition, when looking at other codes, the high rate of the “Partially Using” code also shows that competence and continuity in the use of digital tools should be prioritized. It has been determined that teachers use a wide range of digital tools and it has been observed that game-based learning platforms (Kahoot!, Padlet, Quizizz) are widely preferred. In terms of the pedagogical contributions of digital tools, motivations such as “Making Lessons Interesting” and “Students Being More Active in Lessons” come to the fore (Heick, 2020).

It has also been determined that digital tools are most frequently used in the “Narrative Process” and “Evaluation Process”. In addition, it is seen that teachers use digital tools effectively in national and international projects (TUBITAK, eTwinning). The prominence of codes such as “Making Lessons Interesting” and “Motivating Students in Lessons” in the “Motivations for Using Digital Tools” category highlights the pedagogical value added by digital tools in the learning process. According to Ertmer and Ottenbreit-Leftwich (2010), technological tools have high potential for creating effective learning environments. The findings of this study support these views. Studies showing that digital technologies provide flexibility and diversity in the teaching process can also be found in the literature (Roblyer & Doering, 2014). In this study, the codes “In the Narration Process” and “In the Evaluation Process” were particularly high in the “Processes in Which Digital Tools Are Used” category, indicating that digital tools are used extensively by teachers in the teaching process. There are also studies in the literature supporting this conclusion. This demonstrates the potential for teachers to use digital tools in a multifaceted manner, across disciplines, and beyond their boundaries (Kozma, 2003).

When teachers' perceptions of digital competence are examined, it is understood that they are trying to improve themselves in this field with individual efforts, but supportive education policies are needed due to the prominence of the “Need for More Education” code. The spread of technological integration in education has made teaching processes more dynamic and student-centered. While computers and the internet enable the design of interactive learning environments, they contribute to the development of innovative models such as distance education and online resources (Akbulut vd., 2024). In particular, the code “Need for Further Training” indicates the need to develop digital pedagogical skills (Kurt & İşman, 2022). These findings suggest that education policies need to rethink their priorities regarding teacher education. The results of the research show that teachers have become more proficient in using digital tools over time. In the interviews, teachers stated that the integration of technology into the learning process, especially for Generation Z students, increases motivation and improves the quality of learning. Studies in the literature also reveal that the effective use of technology

in education enriches learning experiences. Research conducted within the scope of the FATIH Project also shows that this initiative enriches learning environments and contributes to teaching processes. Kolburan-Geçer and Bakar-Çörez (2020), in their studies with teachers, concluded that the use of information technologies in education increases motivation, visual elements enhance learning processes, and increase retention of knowledge. These findings demonstrate that effective use of technological tools in education will enrich students' learning experiences and make teaching processes more effective. The role of information technologies in education has the potential not only to increase motivation but also to improve the quality of learning.

Considering that designing an educational process completely independent of information technologies is impossible today and in the future, it can be argued that the effective use of technology in education has become a professional imperative for teachers in our age (Yetik, Akyüz, & Bardakçı, 2019; Kolburan-Geçer & Bakar-Çörez, 2020). Today, it is not possible to design a technology-independent process in education. Therefore, it has become a professional necessity for teachers to be able to use technology effectively. In digitalized educational environments, it is a critical requirement for teachers to increase their professional competencies and align their pedagogical approaches with technological tools. Teachers' increasing technology literacy is an important factor in terms of the efficiency of the education system. The success of technology integration in education is directly related to the professional development opportunities that will be offered to teachers. Therefore, improving teachers' technology usage skills should be considered as a strategic priority to improve the quality of education.

The findings of the research discuss the contributions of digital tools to the educational process and their role in the program from a multifaceted perspective. The data obtained reveal that digital tools support both individual and collaborative learning processes. In particular, its positive effects on individualized learning, interaction between students and motivation are emphasized. These results coincide with studies arguing that the integration of technology into pedagogical methods enhances learning experiences (Hattie & Yates, 2014). In particular, it has been determined that gamification elements increase student motivation and encourage participation in the lesson. For example, the T19 participant stated that gamification elements increased students' interest by triggering a sense of competition. The capacity of digital tools to embody abstract concepts supports the levels of learning described in Bloom's Taxonomy (Bloom, 1956). The fact that digital materials appeal to different senses makes the learning process more inclusive by providing learning opportunities suitable for various types of intelligence (Gardner, 1983). This provides an important advantage, especially for gifted students. While the participants argued that the integration of digital literacy courses into the curriculum would improve students' technology usage skills, some stated that digital tools could not be offered equally to all students due to inequality of opportunity. This situation points to the problem of equality in education by associating it with the concept of digital exclusion (Selwyn, 2011). In addition, it was emphasized that the use of digital tools depends on the competencies of teachers, and the T3 participant stated that teachers should direct this process.

Digital tools also play a critical role in the education of gifted students. Research shows that technology increases the motivation of these students and provides permanent learning by supporting their learning processes (Çalışkan, 2017). Manuel & Freiman (2017) and Çubukçu & Tosuntaş (2018) revealed that digital environments have the potential to support the academic and social development of gifted students. Research findings show that cooperative learning processes are supported by digital tools and these processes strengthen learning by increasing social interaction. Online collaboration

platforms and cloud-based applications contribute to the simultaneous work of students in group projects and the sharing of information. This can be explained by Vygotsky's (1978) theory of social constructivism. The integration of technology makes it easier for teachers to create educational environments that suit different learning styles and individual needs, increasing student engagement and motivation (Dickinson & Bass, 2020). The findings of the research reveal that the effective use of digital tools in education supports the learning processes positively and their integration into the curriculum is important. However, in order for this process to be carried out effectively, it is considered as a critical element that teachers are adequately equipped and that inequalities of opportunity are eliminated.

The findings in the category of "Problems Experienced in Using Digital Tools" show that technical inadequacies limit the effective use of digital tools in education. Internet connection, hardware deficiencies and software errors stand out among these problems. This finding coincides with research emphasizing that infrastructural deficiencies can negatively affect pedagogical processes (Ertmer & Ottenbreit-Leftwich, 2010; Hew and Brush, 2007). Teachers state that the lack of physical equipment in BİLSEMs complicates the educational processes (Sezginsoy, 2007; Tantay, 2010). Individual user-related challenges such as password management and learning new software reveal the importance of developing digital competencies (Koehler & Mishra, 2009). In the category of "Solutions to Problems Experienced While Using Digital Tools", collaborative solutions such as collegial support and technical assistance come to the fore (Vrasidas, 2015). In the category of "Difficulties Caused by Students' Lack of Interest in Digital Tools", the tendency towards traditional methods and the lack of interest in digital tools stand out (Prensky, 2001). In the category of "Balance Difficulties Between Digital Tool and Face-to-Face Education", the difficulty of establishing a balance in hybrid education models draws attention (Graham, 2006). Teachers' lack of technological competence leads to their inability to use digital tools effectively in pedagogical processes. The TPACK model can be used to explain this situation (Koehler & Mishra, 2009).

Lack of digital literacy is an obstacle for both teachers and students, especially older teachers and students with limited access to digital tools have more difficulties in this regard. Studies on the use of technology in the education of gifted students show that infrastructure deficiencies and lack of knowledge are among the important problems (Gökdere, Küçük, & Çepni, 2004; Kolburan-Geçer & Bakar-Çörez, 2020). It is considered critical to provide the necessary infrastructure for the effective use of digital tools and to increase the technology usage skills of teachers. In our study, participants emphasize the need to integrate digital tools into the curriculum and improve the infrastructure. This is in line with studies that indicate the need for infrastructure for the effective use of educational technologies (Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006). In the light of information in the category of "Suggestions for Increasing the Use of Digital Tools", it is emphasized that equal access to digital education should be provided (Selwyn, 2011; Warschauer, 2003). In addition, it is stated that parents should also be made aware of digital literacy, which is in line with the literature showing the importance of involving families in the process (Livingstone & Helsper, 2007).

Statement of researchers

In this section, you are expected to declare the information regarding the titles given below.

Researchers' contribution rate statement

All authors equally contributed to each section of this research together.

Conflict statement

The authors declare that there is no conflict of interest to disclose.

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