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Educators' use of digital technology in early childhood education: Personal and educational environments[1]

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Abstract

Improving and strengthening digital technology (DT) in early childhood education settings is significant. The extent to which educators include DT and its use in their personal lives and educational environments plays a key role in this empowerment. Identifying deficiencies in technology tools, the DTs that need support in educational environments, teachers' experiences with DTs, and the DT applications that should be increased in educational settings will enable more accurate steps to be taken. This study aimed to understand the DT tools that early childhood educators use in their personal and educational environments, the duration of their use, their practices, their feelings of comfort, and their frequency of use. In this study, data were collected from 16 educators working in three different schools in a Midwestern State of the United States. Calculations for frequency, percentage, and mean, along with descriptive graphs, were created. The study's results revealed that educators actively use DT in their personal and educational environments. The use of tablet and smart board tools in educational environments is low, as is the use of social media, communication tools, television, educational videos, and voice recorders. In addition, educators were less comfortable with storytelling programs, digital photo editing, playing computer games, and using drawing programs. The use of web search and word processing applications by children was quite limited, and the frequency of using drawing programs by both themselves and children was very low.

Keywords: Early childhood education, digital technology, digital tools, digital application, educators.

Introduction

The increasing penetration of digital technologies into educational settings has changed the way teachers communicate, select and structure educational resources, and even their teaching practices (Bourbour, 2020). Early childhood education is also expected to include digital technology (DT) applications that focus on the strengths of each child and reflect developmentally appropriate and play-based practices (Lim & Wardrip, 2024). DT encompasses multifunctional tools with internet connectivity, such as desktop and laptop computers, mobile technologies, and digital toys (Aldhafeeri et al., 2016). Providing well-designed activities using digital tools has a positive impact on children's skills (Biancarosa & Griffiths, 2012; Mertala,

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2019). DT in the educational environment enhances children's cognitive, social, and emotional development, strengthens their learning, and supports their academic growth (Kara & Cagiltay, 2017; Lim & Wardrip, 2024). In addition, applications such as computers, tablets, educational games, and multimedia presentations increase children's motivation (Çakıroğlu & Taşkın, 2016; Huffstetter et al., 2010; Istenic et al., 2016). Again, with the use of digital devices such as tablets, computers, and mobile phones, children develop basic literacy skills such as letter writing, word recognition, spelling, vocabulary, comprehension, storytelling, and grammar (Blackwell et al., 2014; Pervolaraki et al., 2017). Kucirkova et al. (2014) found that iPad storytelling apps had a positive impact on children's individual and collaborative engagement and problem-solving skills. Similarly, Lieberman et al. (2009) concluded that digital media products positively affect cognitive skills such as observation, thinking, collaboration, creativity, and problem-solving.

These positive aspects of using DT in educational settings have led to the emergence of some behavioural characteristics for educators. Some of these behaviours include having sufficient knowledge about and mastering the use of DT tools, providing technology resources and infrastructure, and prioritizing the use of technology (Hyndman, 2018). To demonstrate these behaviours, teachers need to have DT use skills. DT use skills are related to the use of strategies such as modeling the use of DT, selecting tools that are appropriate for children's development, giving children the opportunity to practice and exercise in DT applications, using applications that allow children to explore drawing programs, getting children's ideas when solving problems related to DT, using DT tools with children, and ensuring the visibility and accessibility of these tools (Epstein, 2015). The use of these strategies will also be effective in developing children's DT use skills. Children who have access to DT tools, acquire the skills to use them, and can conduct research and experiments using DTs can achieve functionality in DT use (NAEYC, 2012). The use of DT tools such as tablets and smart boards supports children's active participation in education both individually and collectively (Hernwall, 2016).

However, teachers' use of DTs that only support traditional activities, such as showing videos or pictures (Shin, 2014), shows that teachers have difficulties in mastering and using technology. For example, Birden (2022) found that teachers rarely use editing software applications. Ernest et al. (2014) concluded that teachers showed inconsistencies in using software programs for educational purposes. Otterborn et al. (2019) found that teachers' lack of digital skills was among the disadvantages of using tablets.

Having adequate levels of DT tools in educational settings is an important condition for DT use, but it does not explain the situation alone. Teachers' knowledge, skills, and comfort in using DT applications are also important factors in educational environment practices. There is also insufficient evidence on how often teachers use DT tools in the educational environment (Thorpe et al., 2015). Access to technology, time to learn and use technology, need for support and professional development (Ertmer, 1999), beliefs about the educational value of DT, and feeling comfortable with using DT affect teachers' use of DT in academic settings (Ertmer, 1999; Nikolopoulou & Gialamas, 2015; Ottenbreit-Leftwich et al., 2010). Wood et al. (2005) found that teachers' comfort with technology was the only significant predictor of the rate of technology use in educational settings. Batrokova et al. (2024) found that a quarter of teachers do not consider themselves competent in using technology and rarely or never use it in educational settings. Dore and Dynia (2020) found that 30% of teachers are low-technology users or rely solely on television.

It is important to identify and enhance research results on the DT practices that teachers do not consider themselves competent in using, to create the necessary empowerment training. Research examining educators' readiness to use digital technologies in the educational environment, their beliefs, knowledge, and the barriers they face, serves as a primary source for training to improve digital skills (Masoumi, 2021). Considering that educators can use digital tools effectively when supported by training (Blackwell et al., 2013), it would be instructive to identify which digital tools and practices need support. In this study, which is thought to contribute to research in this direction, the DT tools used by early childhood educators, the DT applications they employ in the educational environment, their comfort level with these applications, and the frequency of their use were examined. The results of this study will guide the development of technology equipment for educational environments and the content of in-service training for teachers on the use of DTs.

Current Study

Research emphasizes the importance of using DT in early childhood education to support children's development and learning. However, for this to be possible, in addition to research focusing on educators' views on the use of DT and its impact on children, it is necessary to identify existing and supportable areas of DT use. This study aimed to examine educators' use of DT tools in their personal and educational settings, focusing on which tools are used, how frequently they are used, the comfort felt when using them, and the tools' overall impact. The study sought information in five areas:

RQ1: What are the technology tools that educators use in their personal and educational settings?
RQ2: How many hours a day do educators use DTs?
RQ3: Which DTs do educators use in the educational environment?
RQ4: How comfortable are educators with using DTs in the educational environment?
RQ5: How often do educators use DTs in the educational environment?

Method

The study utilized a cross-sectional descriptive research method, enabling information to be collected from a sample selected from a predetermined population. This sample, selected by the researcher from the universe, possesses certain qualities and features concerning the generalizability of the results obtained (Fraenkel & Wallen, 2009). In this study, educators from three different schools in one of the Midwestern states of the United States, who received support and were willing to use DTs in early childhood education, were selected as the sample. Furthermore, this study is part of a larger project that examines the use of DTs in early childhood education using observation, interview, and document analysis methods, which also influenced the sample selection.

In addition, the most commonly used data collection method in these studies is surveys (Fraenkel & Wallen, 2009). In this study, a survey was conducted among early childhood educators to assess personal and educational environments, and the use of DTs was explained.

Participant

Sixteen educators from three different schools participated in this study. All of the participants, 9 (56.25%) in kindergarten and 7 (43.74%) in preschool, were working in non-profit schools in one

of the Midwestern States of the United States. The participants ranged in age from 32 to 65 years and had between 7 and 35 years of teaching experience. Their educational level was one bachelor's degree (6.25%), one doctorate (6.25%), and 14 master's qualifications (87.5%). Among the teachers, 3 (18,75%) were working as administrators, 1 (6,25%) as a special education teacher, 2 (12,5%) as a 3-year-old, 1 (6,25%) as a 3-4 mixed-age, 3 (18,75%) as a 4-year-old, and 6 (37,5%) as a 5-year-old teacher. Thirteen (81.25%) participants have elementary teaching certificates, and 10 (62.5%) have ZA/ZS endorsements.

Data collection and analyzing

The data were collected through a survey that asked questions developed concerning previous studies (Marsh et al., 2005; Thorpe et al., 2015) on the personal information and views of the participants. In addition to demographic information, the survey provides information in five areas:

-The technology tools that participants own in their personal and educational environments, including computers (desktop, laptop, netbook, tablet), televisions, game consoles, and smartphones

-How many hours do participants use DT in a day

-DT applications used by participants in the educational environment (computer and internet, projector and smart board, television and educational videos, audio recorders, social media, and communication tools, tablet and mobile applications, radio and podcasts)

-Participants' comfort level with using DTs: Assessed using a 13-item self-report questionnaire. Participants were asked to answer the question "*How comfortable are you with using the following technologies?*" about a range of different DTs from "*1 not at all comfortable*" to "*5 very comfortable*".

-Frequency of participants' use of DTs in educational settings: 8-item question *"Please indicate how often you use the following digital technologies in the educational environment in line with the purposes?*". The participants were asked to indicate how often they use these computer-based activities for themselves and the children in their classrooms, ranging from every day to never/never in the classroom for the items of the question: educational games, searching the Web, word processing, and drawing programs.

First, the participants were given a consent form detailing the content and ethical procedures of the study, and their consent for voluntary participation was obtained. Then, the survey form, which started with brief information about the purpose of this study, was shared with the participants via email. Participants were asked to answer all questions fully without any obligation. Finally, data were collected via e-mail from the participants who answered the survey form.

After the obtained data were organized in the SPSS environment, frequency, percentage, and mean calculations of the participants were made for each question in the survey, and descriptive graphs were created.

Ethical approval and informed consent statement

The study was conducted in accordance with the research ethics guidelines of the second

researcher's university, and ethical approval was obtained from the Institutional Review Board (IRB) with reference number STUDY00009529. All participants were informed about the study before participation, and informed consent was obtained.

Results

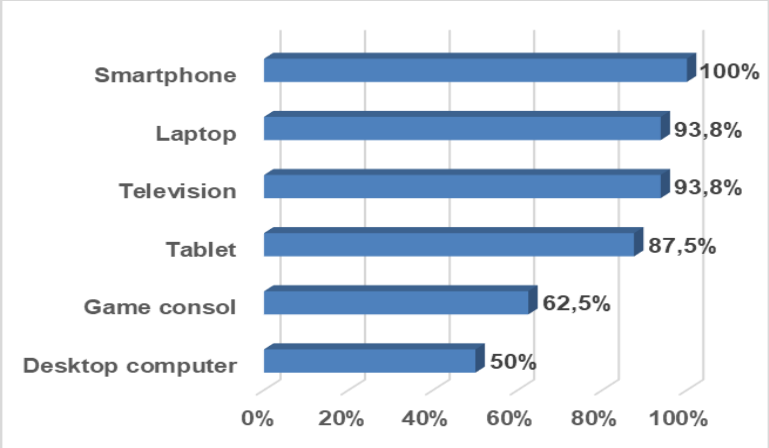
The results obtained regarding early childhood educators' use of DTs in their personal and educational settings are presented in the following order:

Educators;

1. Technology tools they use in their personal and educational environments
2. Daily DT use
3. DT practices they use in the educational environment
4. Comfortable using DT applications in the educational environment
5. Frequency of using DT applications in an educational environment

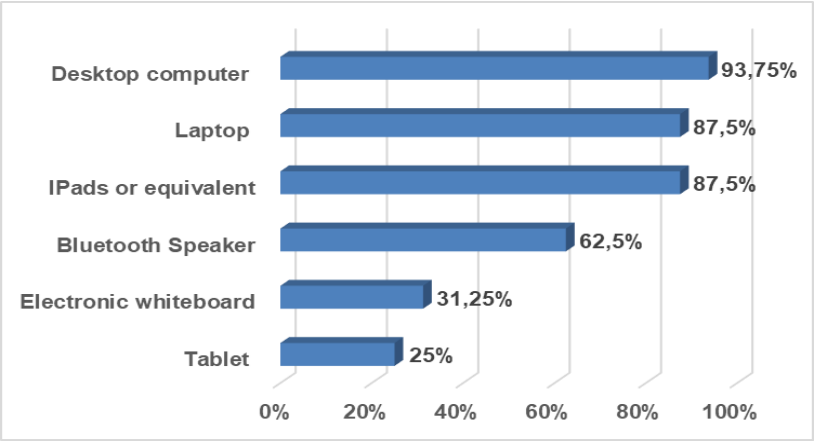
Technology tools used by educators in their personal and educational environments

With each passing day, DTs are becoming more and more present in educators' personal lives and educational environments. The data obtained regarding the DT tools personally owned by the educators are given in Graph 1.



Graph 1 Educators' personally owned digital technologies

All of the participants personally owned a smartphone (n=16, 100%), while the other DT devices they owned were laptop (n=15, 93.8%), television (n=15, 93.8%), tablet (n=14, 87.5%), game console (n=10, 62.5%) and desktop computer (n=8, 50%). The data obtained regarding the DT tools that educators have in their educational environments are given in Graph 2.

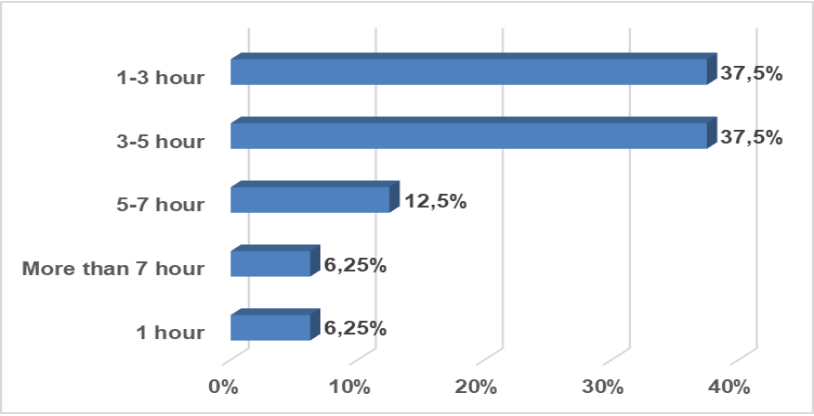


Graph 2 Digital technologies available in the educational environment

Looking at the DT tools that the participants had in their educational environments, it was seen that they had the most desktop computers (n=15, 93.75%), followed by laptops (n=14, 87.5%), IPad or equivalent (n=14, 87.5%), and Bluetooth speakers (n=10, 62.5%), and the least electronic whiteboards (n=4, 25%).

Educators' daily use of DT

Another research question is how long educators use DT tools each day and whether the extent of their DT usage is important for developing their skills. The findings are given in Graph 3.

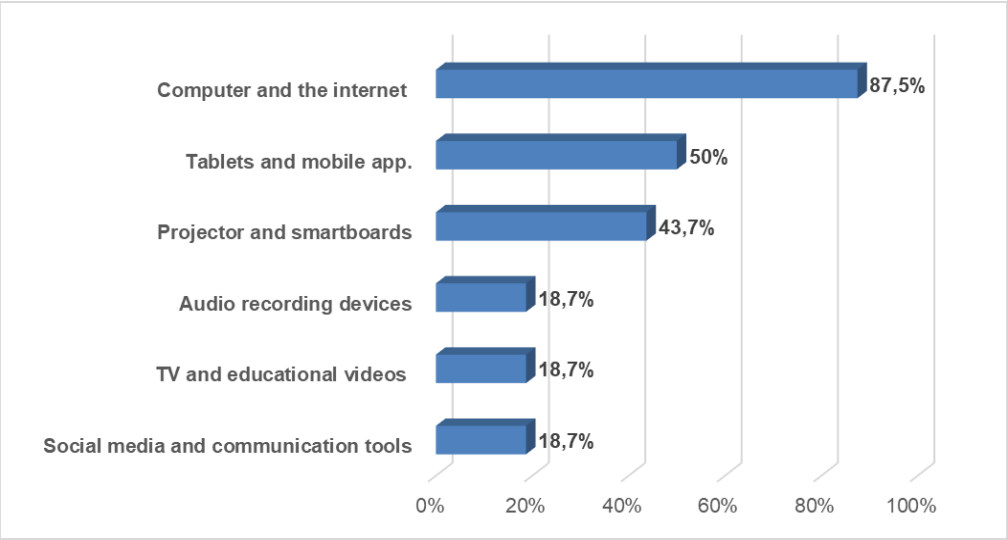


Graph 3 Daily DT usage

It was observed that 12 of the participants used DT between 1-3 and 3-5 hours (n=6, 37.5%), while there were participants who used DT for only 1 hour (n=1, 6.25%) and participants who used DT for more than 7 hours (n=1, 6.25%).

DT practices used by educators in the educational environment

The data obtained regarding the DT practices used by educators with DT tools in educational environments are given in Graph 4.



Graph 4 DT practices used in the educational environment

It was determined that computers and the internet (n=14, 87.5%) were the most frequently used DT applications in educational settings, followed by tablets and mobile applications (n=8, 50%), projectors and smartboards (n=7, 43.7%), and social media and communication tools, television and educational videos and audio recording devices (n=3, 18.7%) were the least frequently used DT applications.

Educators are comfortable using DT applications in the educational environment

Educators were asked to rate their comfort level in using DT applications in educational settings from least to most comfortable. DT applications in educational settings are given in Table 1.

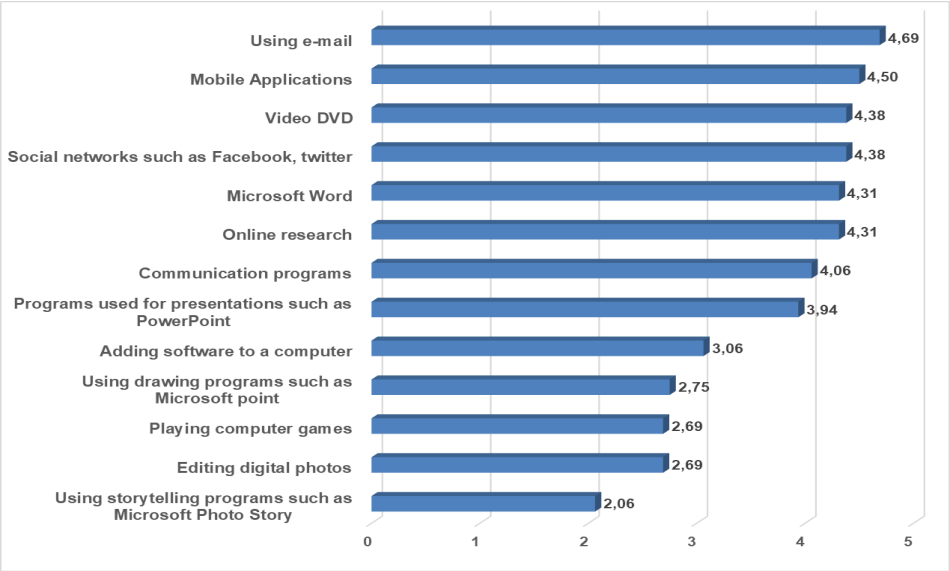
Table 1 Educators comfortable using DT applications in educational settings

	Not at all comfortable	A little comfortable	Moderately comfortable	Comfortable	Very comfortable
Using e-mail	0%	0%	6,3%	18,8%	75%
Mobile Applications (*e.g., smartphones or tablets*)	0%	0%	12,5%	25%	62,5%
Video DVD	0%	0%	12,5%	37,5%	50%
Microsoft Word	0%	0%	18,8%	31,3%	50%
Social networks such as Facebook, Twitter	0%	0%	12,5%	37,5%	50%
Online research	0%	0%	18,8%	31,3%	50%
Communication programs (*e.g., Zoom, Skype*)	6,25%	0%	12,5%	43,8%	37,5%
Programs used for presentations, such as PowerPoint	12,5%	0%	6,25%	43,8%	37,5%
Adding software to a computer	18,8%	18,8%	18,8%	25%	18,8%
Playing computer games	12,5%	25%	43,8%	18,8%	0%
Using drawing programs such as Microsoft Paint	31,3%	12,5%	18,8%	25%	12,5%
Editing digital photos	18,8%	31,3%	25%	12,5%	12,5%
Using storytelling programs such as Microsoft Photo Story	43,8%	25%	18,8%	6,3%	6,3%

Note: (1) Not at all comfortable, (2) A little comfortable, (3) Moderately comfortable, (4) Comfortable, (5) Very comfortable. n = 16

The most comfortable DT applications used by the participants were e-mail (n=12, 75%) and mobile programs (n=10, 62.5%), while the DTs that they were not at all or very little comfortable

using were using storytelling programs (n=11, 68.8%), editing digital photos (n=8, 50.1%), and drawing programs (n=7, 43.8%). The average comfort levels of using DT applications in educational environments are given in Graph 5.



Graph 5 Mean of educators' feelings of comfort using DT applications in the educational environment

When the participants' comfort level in using the DT applications is examined, it is seen that they are "comfortable" using the majority of the applications above the average. At the same time, they are "very slightly comfortable" using storytelling programs (M=2.06, *SD*=1.34), editing digital photos (M=2.69, *SD*=1.29), playing computer games (M=2.69, *SD*=0.88), using drawing programs (M=2.75, *SD*=1.45) and "moderately comfortable" adding software to a computer (M=3.06, *SD*=1.43).

Educators' frequency of using DTs in the educational environment

Educators were asked to rate the frequency of their use of DT applications in educational settings, from most to least frequent use. The frequency percentages of using DT applications in educational settings are given in Table 2.

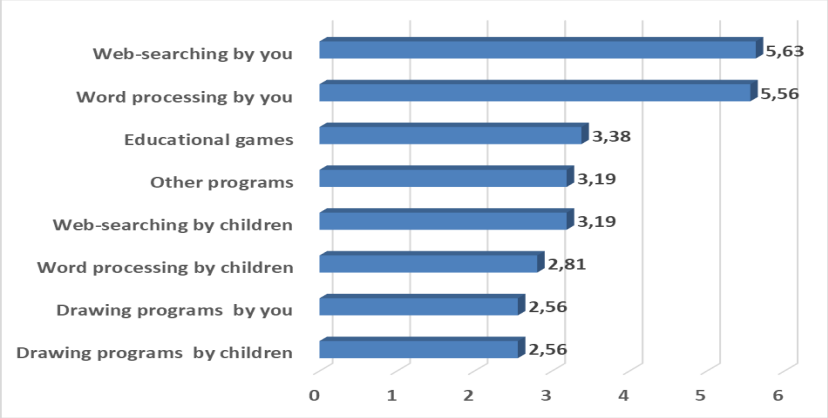
Table 2 Frequency of using DT applications in educational settings

	Every day	Most days	Some days	Not weekly	Never	Do not have in classroom
Drawing programs by children	12,5%	0%	6,25%	0%	75%	6,25%
Drawing programs by you	6,25%	0%	12,5%	12,5%	62,5%	6,25%
Word processing by children	12,5%	0%	0%	31,25%	56,25%	0%
Wb-searching by children	12,5%	0%	18,75%	31,25%	37,5%	0%
Educational games	18,75%	6,25%	12,5%	6,25%	37,5%	18,75%
Other programs	25%	0%	25%	0%	31,25%	25%
Web-searching by you	81,25%	6,25%	12,5%	0%	0%	0%

Note: (6) Every day, (5) Most days, (4) Some days, (3) Not weekly, (2) Never, (1) Do not have a classroom. n = 16.

Table 2 shows that the participants used web search (n=14, 87.5%) and word processing (n=14, 87.5%) DT applications "every day" or "most days" for themselves, but the frequency of use of both DT applications by children was quite low (n=2, 12.5%). It was determined that the participants did not use drawing programs for both themselves and their children (n=11, 68.75%; n=13, 81.25%), with the options of "never" and "not in class". The frequency of DT practices use

in the education process, according to averages, is shown in Graph 6.



Graph 6 Mean frequency of use of DT applications in educational environment

In Graph 6, it is noteworthy that the participants did not use DT applications with the options of "some weeks" or "never". It is seen that they prefer to use web-searching (M=5.63, SD=0.71) and word processing (M=5.56, SD=0.72) applications frequently for themselves, while their use by children (M=3.19, SD=1.32; M=2.81, SD=1.32) is quite limited. Another striking result was the low frequency of use of drawing programs by both educators (M=2.56, SD=1.20) and children (M=2.56, SD=1.45). Educational games (M=3.38, SD=1.89) and other programs (M=3.19, SD=1.68) were also used in some weeks, although not weekly.

Discussion

This study's results underline the extent to which early childhood educators use DT in their lives and educational settings. When related studies are examined, it is noted that although educators have positive attitudes toward the use of DTs, their use in educational settings is limited (Bay, 2022; Demir, 2015; Konca & Tantekin Erden, 2021; Thorpe et al., 2015). Similarly, Magen-Nagar and Firestarter (2019) found that early childhood educators use DTs as a source of information and instructional demonstrations rather than as a tool for implementing new teaching strategies. While there may be many reasons behind this limitation, the lack of DT tools in educational settings, teachers' difficulties in using DT applications, or insufficient space for their use may be practical. This study, which was part of a project on the use of DTs in early childhood education in one of the Midwestern states of the United States, assessed five aspects of DT use: (1) educators' personal and educational use of technology tools, (2) hours of daily use of DTs, (3) use of DTs in educational settings, (4) comfortable with using DTs in educational settings, and (5) frequency of use of DTs in educational settings.

It is essential for educators, who play a key role in using DT in the educational process, to enrich the educational environment by incorporating technology (Bourbour, 2020). Access to high-quality, up-to-date DT tools and the potential for interaction with children through these tools are motivational for teachers (McElearney et al., 2018). In this study, it was observed that educators have DT tools such as desktop computers and laptops in both personal and educational settings. The results of this study are consistent with previous studies on educators' use of DT (e.g., Batrakova et al., 2023; Bay, 2022; Dore & Dynia, 2020; Pila et al., 2019; Öner, 2020; Sheikh et al., 2024). Konca and Tantekin Erden (2021) examined the use of DTs in early childhood education classrooms and found that teachers used computers, television, the internet, DVDs, projectors,

smartphones, digital cameras, and tablets, ranked from most to least frequently. Dwyer et al. (2019) found that early childhood education teachers primarily use smartphones in their personal lives. In the educational environment, they predominantly use desktop computers, followed by laptops, tablets, and smartphones. Pila et al. (2019) found that preschool teachers have internet access, computers, and tablets in their educational environments, and that access to technology has increased. Dore and Dynia (2020) found that teachers use tablets and computers the most in the educational environment, followed by smartphones and television. They also found that teachers use digital resources, including websites, social networking sites, discussion forums, and other multimedia-sharing platforms, as well as existing applications and software designed for professional use.

However, DT tools in educational environments are lagging compared to home environments (Arrow & Finch, 2013). The low rates of tablets (25%) and smart boards (31.25%), which are expected to be more common in educational settings, also show the need to support these environments in terms of DT tools (Bay, 2022). Similarly, Öner (2020) concluded that smart boards and tablets are used the least in the educational environment, where technology tools are used less than in the home environment. Tablets (Blackwell et al., 2016), which are especially suitable for children because they are touch screens and portable, are valuable in enabling children to play games and develop their creativity, as well as enabling collaborative work by enabling multiple children to interact with the screen at the same time (Marsh et al., 2015; Blackwell et al., 2016).

In the findings, it was determined that some educators used DT for 5 hours or more (25%). Similarly, in Bay's (2022) study, it was observed that some teachers used DT for 5 hours or more (31.6%). Although the amount of time allocated for DT use seems important in developing DT use skills, how efficiently this time is spent is also crucial. In particular, the fact that the educators did not feel comfortable using storytelling programs, editing digital programs, playing computer games, using drawing programs, or adding software to a computer indicates a lack of necessary experience with these applications. Therefore, it is thought that using the allocated time for DT effectively and efficiently will lead to a more comfortable use of DT applications.

Another striking result is that social networks (87.5%), video DVDs (87.5%), and communication programs (81.3%), which educators stated they use comfortably and very comfortably in educational settings, have low usage rates (18.7%) among the DTs used in these environments. Transferring these DTs to teachers by enriching them with examples of their use in educational practices may increase their use in educational settings. As a matter of fact, in Bay's (2022) study, the use of video DVDs and communication programs was similarly low, while the use of social networks was high. This result may indicate that the use of DTs in educational settings could increase.

It is also noteworthy that there are applications, such as drawing programs, that educators do not feel comfortable using DTs, and the frequency of using these applications in the educational environment is low. Similarly, it was observed that teachers used DT applications, which they thought did not have sufficient usage level, less frequently in the educational environment, in Safit et al.'s (2015) study. It is similar to the results of the related studies that teachers use DT applications infrequently in educational settings. Birden (2022) also found that although some DTs were useful to teachers, their use in educational settings was low. Nikolopoulou (2021)

examined teachers' use of mobile technologies in educational settings and found that teachers use them 2-4 times a week at most. The under-incorporation of DT applications in educational settings suggests that teachers are more cautious about the importance of DT for children and less sure about its educational value (Thorpe et al., 2015).

DT applications provide children with instant and visual access to the world outside the educational environment, offering them the opportunity to associate their learning with the outside world (Arrow & Finch, 2013). For this purpose, planning and implementing the use of DT in a child-centred manner is seen as the most effective method (Fantozzi, 2018). However, in this study, it was observed that educators gave minimal space to the use of web-searching and word-processing applications by children, who frequently use them. Similarly, Konca and Tantekin Erden (2021) found that teachers provide limited space in educational environments for DT applications, except for watching videos or listening to music, where children are more passive. Öner (2020) concluded that most teachers struggle with using technology or have only basic skills, and that its use in the educational environment is mainly limited to watching videos or listening to music, where children are passive. Dong (2018) concluded that a quarter of the teachers never included DT applications for preschool children, while half of them rarely did. The minimal use of DT practices by children indicates that DT is primarily employed to support teacher-centred teaching practices (Palak & Walls, 2009). The finding that teachers use DT in teacher-centred practices rather than child-centred learning (e.g., Flewitt et al., 2015; Lim & Wardrip, 2024) supports this situation.

The findings draw attention to the need to provide support for diversifying and increasing the DT tools available in educational settings, to empower educators through training on DTs that they do not feel comfortable using, to increase the frequency of use of DT tools and DT applications that educators prefer to use less in educational settings, and to give more space to DT applications that are used especially by children. It also contributes to studies concluding that the use of DT in early childhood education is limited by revealing the factors affecting its use. To ensure digital equality in early childhood education settings, providing in-service training on DT use is seen as the best solution (Livingstone, 2012; Thorpe et al., 2015).

Limitations and future directions

This study determined the extent to which early childhood educators include DTs in their personal and daily lives and their use of these technologies in the educational environment. The results of the study will help determine the areas where educators need DT tools and their usage, as well as plan the necessary support. However, this study has some limitations. The sample of this study, which is part of a comprehensive project, is small, and its generalizability is limited to the micro-level. More comprehensive studies are needed to support the main findings of the research.

The effectiveness of DTs depends not on the tools themselves but on their use in the educational setting, which requires a closer look at children's interactions with these DTs (Lim & Wardrip, 2024). The findings of this study are based on a single source, and validating them with observational studies would enhance the understanding of the comfort and frequency of using DTs. In this way, it will be possible to evaluate whether educators who express themselves as very comfortable using these applications may not be comfortable purposefully using them. Additionally, they may not be able to involve children in the learning process with DT.

Finally, planning longitudinal studies, implementing intervention programs, and examining the processes of children's involvement in DT applications in home and school environments can be future research directions to understand the development and changing needs of educators in the use of DT.

Declaration of conflicting interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

The study data is stored in a password-protected database on a password-protected computer. When the researchers are contacted, they can access the data.

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