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Digital Technology (DT) Usage of Preschool Teachers in Early Childhood Classrooms

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Ahmet Sami Konca* **Feyza Tantekin Erden****

Abstract

This cross-sectional survey study aims to investigate preschool teachers' usage of digital technologies (DT) in early childhood education. To investigate teachers' use of DT, a questionnaire was completed by 167 preschool teachers from 52 different preschools. Besides, the Attitude Scale for Technological Tools and Materials Use in Preschool Education was completed by the teachers. The results of the study revealed that the classrooms were equipped with a variety of DT such as television, DVD, computer, and smartphone. Teachers tended to use television and computers in the classroom activities. Although the teachers had a positive attitude towards using DT in early childhood education, they used ICT on a limited scale. They mainly utilized these devices in order for the children to watch cartoon films and listen to music. Gender, teaching experience, and attitudes of teachers towards using ICT did not significantly predict their DT usage in their classroom activities. The results imply that though teachers had enough DT sources and positive attitude towards using those devices in their classroom activities, their DT usage was limited to few types of activities. For improving the quality of DT use in the classrooms by teachers, barriers to teachers' successful technology integration in their classrooms should be determined.

Keywords: Digital technologies, early childhood education, preschool teachers.

* *Corresponding Author:* Assist. Dr., Erciyes University, Faculty of Education, Deparment of Early Childhood Education, Kayseri, Turkey. E-mail: samikonca@erciyes.edu.tr, https://orcid.org/0000-0002-6423-6608

** Prof. Dr., Middle East Technical University, Faculty of Education, Department of Early Childhood Education, Ankara, Turkey. E-mail: tfeyza@metu.edu.tr, https://orcid.org/0000-0001-6060-1877

Okul Öncesi Öğretmenlerinin Okul Öncesi Eğitimde Dijital Teknoloji (DT) Kullanımı

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Ahmet Sami Konca[*] **Feyza Tantekin Erden**[**]

Öz

Bu kesitsel tarama araştırmada okul öncesi öğretmenlerinin dijital teknolojileri (DT) okul öncesi eğitimde kullanımlarını incelemeyi amaçlamıştır. Çalışmada öğretmenlerin DT'ye yönelik tutumlarını ve sınıf içi kullanımlarını belirlemek amacıyla Okul Öncesi Eğitimde Teknolojik Araç Gereç Kullanımına Yönelik Tutum Ölçeği ile araştırmacılar tarafından hazırlanan bir anket formu kullanılmıştır. Çalışmaya 52 farklı anaokulundan 167 okul öncesi öğretmeni katılmıştır. Araştırmanın sonuçlarına göre sınıflarda televizyon, DVD, bilgisayar ve akıllı telefon gibi farklı DT'ler bulunmaktadır. Öğretmenler genellikle etkinliklerde televizyon ve bilgisayarları kullandıklarını belirtmişlerdir. Öğretmenler okul öncesi eğitimde DT kullanmaya yönelik pozitif tutuma sahip olmalarına rağmen, sınıf içerisinde sınırlı şekilde, genellikle çocuklara çizgi film izletmek ve müzik dinletmek amacıyla DT kullanmışlardır. Öğretmenlerin cinsiyeti, kıdemi ve okul öncesi eğitimde teknoloji kullanmaya yönelik tutumlarının sınıf içi etkinliklerde BİT kullanımlarıyla herhangi bir ilişkisi belirlenmemiştir. Bu araştırma sonuçlarına göre öğretmenler yeterli DT ve olumlu tutumlarına rağmen DT'yi sınıf içi etkinliklerde sınırlı düzeyde kullanmaktadırlar. Öğretmenlerin sınıf içi DT kullanımlarının niteliğinin artırılması için uygun teknoloji entegrasyonunun önündeki engeller belirlenmelidir.

Anahtar Sözcükler: Dijital teknoloji, okul öncesi eğitim, okul öncesi öğretmenleri.

[*] *Sorumlu Yazar:* Dr. Öğr. Üyesi, Erciyes Üniversitesi, Temel Eğitim Bölümü, Okul Öncesi Eğitimi Anabilim Dalı, Kayser, Türkiye. E-posta: samikonca@erciyes.edu.tr, https://orcid.org/0000-0002-6423-6608

[**] Prof. Dr., Orta Doğu Teknik Üniversitesi, Eğitim Fakültesi, Temel Eğitim Bölümü, Okul Öncesi Eğitimi Anabilim Dalı, Ankara, Türkiye. E-posta: tfeyza@metu.edu.tr, https://orcid.org/0000-0001-6060-1877

Introduction

Digital technologies (DT) are now a fundamental part of modern daily life (Edwards, 2016). This diffusion surrounds young children and a number of studies have revealed young children's intensive interaction with information and communication technologies (ICT) from a broad perspective (Christakis, Ebel, Rivara & Zimmerman, 2004; Marsh et al., 2005; Nikolopoulou, Gialamas, & Batsouta, 2008; Rideout, Vandewater, & Wartella, 2003). These studies have underlined the significance of the issue, with research concerning the integration of ICT into early childhood education (ECE) having emerged.

The integration of DTs into ECE, and the question of whether or not it is effective, have been around since the 1980s. First, it was claimed that DTs were harmful for young children and that using it in ECE was ineffectual (Cordes & Miller, 2000; Cuffaro, 1984; Haugland, 2000; Healey, 1998; Hohmann, 1998). On the other hand, some researchers emphasized the uniqueness of DTs in the education of young children and conducted research investigating the integration of DTs into ECE (Clements & Sarama, 2003; Lankshear & Knobel, 2003; Plowman & Stephen, 2005). Rapid changes in technology have provided new forms of DT and the demands for the integration of DTs into ECE have emerged (Yelland, 2011). Furthermore, some countries have developed policies in order to maximize their benefit from DTs and to integrate them into ECE (Learning and Teaching Scotland, 2003).

However, Turkey has no policy with regards to the integration of DT into ECE. Yet, in order to determine the current situation. Therefore, the current quantitative research is concerned with investigating the availability of DT in the ECE setting, and the usage of DTs in the activities designed by teachers.

Teachers and DT in ECE

Many research studies about the use of DT in ECE focus only on computers (Inan & Lowther, 2010). However, DT concepts include computers, printers, telephones, smartphones, electronic toys, Internet connections, tablet computers, interactive whiteboards, digital cameras, facsimile machines, and voice recorders, etc. (Bolstad, 2004; Plowman & Stephen, 2005). These varied forms of DT may provide opportunities to support many aspects of ECE (Mishra & Joseph, 2012). DTs may support children's learning and enrich game experiments. Furthermore, it may strengthen the professional development of educators and facilitate communication between kindergartens and parents. Thus, DT attracts teachers because of its' features that assist the learning of children and the professional development of teachers.

In 2012, the National Association for the Education of Young Children (NAEYC), together with the Fred Rogers Centre, revealed a position statement about the use of technology and interactive media. The statement was intended as a guide for early childhood educators about the developmentally appropriate use of technology. It presented general information about technology in ECE and suggestions for issues such as duration of screen usage, the appropriate use of DTs, equity, etc. It also emphasized that technology could be an effective tool when used actively, appropriately, and in an educationally sound manner. The statement cautioned about a lack of digital literacy that may result in making inappropriate choices which negatively influence the development and learning of young children. The principles of the statement aimed to decrease the effect of different teacher characteristics in order to ensure correct usage of technology in the education of young children.

The influencing characteristics of teachers on their DT usage in ECE can be analyzed in three categories. First, background variables such as grade and experience in education may affect their DT usage. DT used in ECE should be appropriate to the child's developmental level (Bolstad, 2004). Both the age and years of experience of a teacher can influence their DT integration (Inan & Lowther, 2010). Second, teacher self-efficacy is related to DT usage in the classroom (Sang et al., 2010). Third, the characteristics of teachers relating to DT may be important factors influencing DT usage in the classroom. The DT competency of teachers can be a barrier to the application of DT in ECE (Hew & Brush, 2007; Sang et al., 2010). Additionally, Tsitouridou and Vryzas (2004) emphasized that teachers' experience with DT affects their use of DT in ECE. Furthermore, the attitudes of teachers towards DT in the classroom may explain their usage of DT (Inan & Lowther, 2010).

ECE and DT in Turkey

ECE is centrally organized in Turkey, and the main body of policy is the Ministry of National Education (MoNE). The MoNE put into practice the latest ECE program in 2013 (Milli Eğitim Bakanlığı [Ministry of National Education], 2013). The program is designed for 36-72 months old children, and aims to provide enriched learning environments; to support motor, social-emotional, language and cognitive development; and to prepare children for elementary education. As the program focuses on all aspects of development, it is defined as a developmental program. Spiral approach and eclectic model are other key components of the program. The developmental capabilities of children are presented according to age groups. The program provides objectives and indicators to teachers. Teachers have the responsibility of designing daily and monthly plans based on the objectives and indicators, and are in charge of fitting the objectives with developmental capabilities of the children in their classes. Additionally, teachers can add objectives if needs be that do not exist in the current program.

The MoNE initiated the national F@TIH project which aims to technologically equip classrooms from the elementary level right through to high school (Tezci, 2011). Though the project does not actually cover preschool classrooms, some forms of DT such as televisions and computers have been made available within the ECE setting. In preservice training, basic courses are offered in order to improve the computer efficacy of preschool teachers. Besides, there is no in-service training which is aimed at developing preschool teachers' familiarity with DT (Milli Eğitim Bakanlığı [Ministry of National Education], 2016).

When recent studies in Turkey are examined, it can be seen that Turkish preschool teachers have positive attitudes towards the use of technology in the classroom (Konca, Özel, & Zelyurt, 2016). Besides, the preschool teachers emphasized positive roles and DT and defined DT as a necessity (Korkmaz & Ünsal, 2016). In a recent study, Simsar and Kadim (2017) investigated how preschool teachers' usage of DT impacted on their teaching. The study revealed that preschool teachers used the digital technologies for musical and play activities. However, some preschool teachers pointed to certain difficulties in terms of DT hardware and a lack of technical support from the institution in which they worked (Kabadayı, 2006; Simsar & Kadim, 2017). This expression parallels the view that technology supports the learning of children, but is also difficult to use (Lindahl & Folkesson, 2012). Hence, teachers prefer to use DT mostly for the preparation of plans and for music-based classroom activities (Yurt & Cevher-Kalburan, 2011).

In Turkish context, there are certain questions that, if posed, may provide useful information for early childhood educators and policymakers alike,

1) Which forms of DT are available for the ECE setting?
2) How do preschool teachers use DTs in their activities?
3) Which characteristics of teachers affect their DT usage in ECE?

Within the framework of these three questions, this study focuses on availability of DT in early childhood classrooms, and preschool teachers' usage of DTs in the activities.

Method

Research Design

This quantitative study was a cross-sectional descriptive survey. The cross-sectional survey collects information at one point in time from a predetermined population (Fraenkel & Wallen, 2009). Through surveying preschool teachers, availability of DT in early childhood classrooms, and preschool teachers' use of these devices were described in this study. Moreover, teachers' usage was compared according to their demographic characteristics.

Research Sample

Convenience sampling method was employed as a sampling method in this study. The sample of the current study consists of 167 preschool teachers who were working at an early childhood education school in a city which was situated in central region of Turkey, near to the capital city. 91% of the teachers were female and 9% of them were male. The age of the teachers ranged from 22 to 40

years old, and the mean age was 26.5 years with 3.67 standard deviations. Additionally, 89.2% of the teachers held a bachelor's degree and 10.8% held a lower (two-year) degree with a certificate as a preschool teacher. Their teaching experience varied from 1 to 16 years, with a median of 5 years. Furthermore, 90.4% of the teachers worked in public schools, with the remaining working in private schools.

Research Instruments and Procedures

The data were collected from 52 different preschools. Of the settings, 12.7% were for children aged three, 23.5% for age four, 52.7% for age five, and 10.8% for age six. In order to collect data for the study, the "Attitude Scale for Technological Tools and Materials Use in Preschool Education" (STTPE) developed by Kol (2012b) was used. The scale included 20 Likert-type items. 14 items were designed as positive and 6 items were negative. Each item had a range that varied from 1 to 5. Higher score derived from the scale mentioned more positive attitude of the preschool teacher towards technological tools and their usage in classroom materials. The Cronbach Alpha value was calculated as being .88.

Moreover, a questionnaire named "Digital Devices in Early Childhood Classrooms" was developed and used by the researchers. The main purpose of the developed questionnaire was to investigate the technological tools available in the classroom, and the teachers that utilize them in their classroom activities. Part I of the questionnaire focused on the teachers' demographics. Then, Part II investigated the availability of certain forms of DT and the teachers' usage in their activities. First, availability of a specific DT was asked to the participant teacher. Then, a variety of activities including DT were shown and the frequency of designing such activities questioned. Part III consisted of 3-point, Likert-type items concerning teachers' self-perceptions of their DT skills. To ensure reliability of the scores of the tool, Cronbach Alpha was also calculated, with a value returned of .79.

Descriptive analysis was used to present the teachers' usage of DT in their classrooms, and their attitude scores. Multiple regression testing was employed in order to investigate whether or not the participants' gender, teaching experience, or attitudes towards using DT predicted the teachers' usage of DT in their classroom activities.

Findings

Figure 1 illustrates the availability of specific forms of DT in the ECE classrooms. As it can be seen in Figure 1, the most widespread forms of available DT were computers (66.5%) and TVs (57.5%). Complementary to computers, Internet access was also available in more than half of the classrooms. The availability of DVDs was found to be 45.5%. Additionally, as a hardware item associated with computers, one-third of classrooms also included projectors. With regards to touchscreen technologies, the percentages of availability for smartphones and tablet computers were 32% and 9%, respectively. Furthermore, 20% of classrooms had a digital camera.

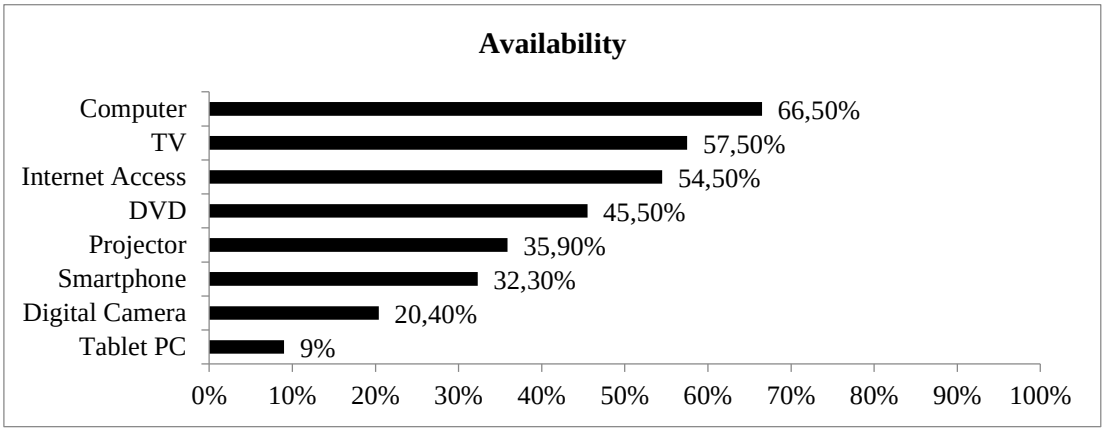

Figure 1. *Availability of DT in the ECE Classrooms*

TV may be thought of as a traditional technology and the most widespread form of DT. However, it is interesting to note that the percentage of computers being available was higher than for TVs. It seems that the coupling of computers and Internet access was more prevalent than TVs and DVDs.

Table 1 presents the preschool teachers' use of DT in their classroom activities. First of all, the teachers preferred to use technology in activities in which the children were inactive. The teachers had the tendency of using TV and computers in their activities. They would utilize TVs in order for the children to watch cartoon films or documentaries.

Table 1
Teachers' use of DT in the activities

		Never	Rarely	Sometimes	Frequently	Always
1	Children watch cartoon films, or documentaries on TV	38.9%	12.6%	22.8%	13.8%	12.0%
2	Children use computers individually	61.7%	17.4%	14.4%	3.0%	3.6%
3	Children use computers within a group	61.1%	18.0%	14.4%	4.2%	2.4%
4	Children play games on a computer	74.9%	9.0%	11.4%	3.6%	1.2%
5	Children draw pictures using software such as Paint	70.1%	12.0%	11.4%	4.2%	2.4%
6	Children listen to music on a computer	34.7%	4.8%	12.0%	16.2%	32.3%
7	Children watch videos on a computer	35.3%	7.8%	14.4%	18.0%	24.6%
8	Children access websites designed for them	80.8%	7.8%	6.6%	4.2%	0.6%
9	Children take photographs using a digital camera	85.0%	6.0%	4.8%	1.2%	3.0%
10	Children record videos using a digital camera	89.2%	3.6%	4.8%	1.2%	1.2%
11	Children record videos using a video camera	91.0%	3.6%	4.2%	0.6%	0.6%
12	Children play games on a tablet computer	89.8%	4.2%	4.2%	1.2%	0.6%
13	Children investigate digital storytelling books on a tablet computer	84.9%	7.2%	3.6%	3.6%	0.6%

When it comes to computers, listening to music and watching videos were the main activities. It can be said that computers are used like a TV, with the teachers utilizing them in order to get the children to watch or listen. On the other hand, the use of smartphones, tablet computers, and digital camera in the classroom activities were uncommon in ECE.

Descriptive findings of the teachers' scores towards using DT in ECE are presented in Table 2. It can be seen that the minimum score was 2.3, and the maximum was 5.0, which is at the top of the scale. Furthermore, the mean score was 3.93 with 0.57 standard deviation. These scores illustrate that the preschool teachers were keen on using DT in ECE.

Table 2
Preschool teachers' attitudes

	Minimum	Maximum	Mean	Std. Dev.
Teachers' Attitudes Towards Technological Tool and Material Use in Preschool Education	2.3	5.0	3.93	0.57

A multiple linear regression was examined to predict teachers' DT usage in their classroom activities based on gender, teaching experience, and the attitudes of teachers towards using DT. The results are presented in the table below. The analysis results show that the linear combination of gender, teaching experience, and attitudes of the teachers did not significantly predict their use of DT in ECE ($R = .135$, $F = .960$, $p > .05$).

Table 3
Results of Multiple Regression Analysis between predictor variables and preschool use of DT in ECE

Multiple Regression	Analysis of Variance				
$R = .135$	Source	*df*	*SS*	*MS*	*F-ratio*
$R^2 = .018$	Regression	3	325.010	108.337	.960
$SE = 10.625$	Residual	154	17387.517	112.906	

Discussion

A variety of DT were reportedly available in early childhood classrooms. The most widespread forms of DT were computers, televisions, Internet access, and DVDs, and less so were touchscreens (smartphones and tablet computers), and digital cameras. In another study, Yurt and Cevher-Kalburan (2011) reported the availability of computers and Internet connection in the classrooms as 64.2% and 32.6%, respectively. When these percentiles are compared to the results of the current study, the availability of computers was seen to be similar, but the availability of Internet was significantly higher in the current study. The increase may go towards explaining the higher level of availability seen for computers than TVs, which is a traditional and one of the most widespread form of DT. A higher percentile of computers over TVs can also be found in the literature (Blackwell, 2015). However, guaranteeing teachers' access to DTs may not be sufficient in itself for them to utilize these technologies effectively (National Education Association-American Federation of Teachers, 2008). Engaging, child-centered activities (NAEYC& Fred Rogers Center, 2012), and a balance of traditional and digital activities that comply with screen usage time limit recommendations (American Academy of Pediatrics, 2011) are other aspects deemed pertinent to the successful and developmentally appropriate integration of DT into ECE.

Kerckaert, Vanderlinde, and van Braak (2015) distinguished DT usage in ECE as two types: (i) "DT use supporting basic DT skills and attitudes," and (ii) "DT use supporting contents and individual learning needs." Teachers have the tendency of using DT as the first type, with their usage of technology primarily aimed at the preparation of materials or activities, rather than utilizing DTs for student learning (Russell, Bebell, O'Dwyer, & O'Conner, 2003). In the current study, the preschool teachers used mainly televisions and computers in their activities in order to support the content of their teaching activities. However, they preferred inactive types of activity such as using technology for the children to watch films or to listen to music as part of their activities. According to Yurt and Cevher-Kalburan (2011), more than half of the teachers in their study used computers to search for activities and information/material via the Internet. However, only one-third of teachers used computers to support learning in the classroom. Furthermore, the teachers tended to use computers in musical activities (Yurt & Cevher-Kalburan, 2011).

Teachers aim to increase the quality of education by using DT in the teaching due to the wealth of audiovisual material available (Kol, 2012a). However, technology can be underused in ECE because of certain perceived limitations (Wartella, Blackwell, Lauricella, & Robb, 2013). Some barriers seen to using DT in ECE have been defined by researchers as a lack of hardware and software, lack of funding, lack of technology-related skills of the teachers and children, lack of time, lack of preparation to use technology to support learning, and lack of perception of possible uses of DT in ECE (Chen & Chang, 2006; Ihmeideh, 2009; Sandberg, 2002; Turbill, 2001). Additionally, class conditions have been reported to limit the use of technology in ECE (Nikolopoulou & Gialamas, 2015a). Teacher attitudes and philosophies of instruction also may be obstacles to the implementation of child-centered teaching practices (Blackwell, 2013).

Teachers' beliefs play a crucial role in DT integration, as they can directly affect the behaviors of teachers in the classroom (Webb & Cox, 2004). Thus, early childhood teachers' positive views can positively influence their use of DT in teaching (Sime & Priestley, 2005). Besides, teachers' perceptions about the usefulness and benefit of DT in the teaching process are significant in order to determine their scope of using DT in their teaching (Hu, Clark, & Ma, 2003). The positive attitudes of teachers towards utilizing DT in ECE is fairly well reported, except for one neutral perception (Jimoyiannis & Komis, 2007). In the current study too, preschool teachers were reported to have higher levels of positive attitude towards using DT in ECE. Yurt and Cevher-Kalburan (2011) pointed out that early childhood teachers may see computers as being appropriate to ECE. Landerholm (1995) also reported on the positive attitude of early childhood teachers towards using computers in their teaching. Nikolopoulou and Gialamas (2015b) pointed to a very strong belief that DT is beneficial to the learning of young children. In this direction, preschool teachers should aim to increase the quality of education by utilizing DT within the teaching process (Kol, 2012a). The willingness of preschool teachers to use DTs may be useful as a means to address the barriers to successful and developmentally appropriate integration of DT in ECE.

One of the aims of the current study was to investigate which factors influence DT usage by preschool teachers. As stated in the literature, the background characteristics of teachers may affect their DT usage in ECE (Bolstad, 2004; Inan & Lowther, 2010; Kerckaert et al., 2015). However, in the current study, the teachers' gender, their teaching experience, and the attitudes of teachers were not found to influence their DT usage. These nonsignificant results may be thought of as positive on the issue of equity in ECE. Yet, other variables that may affect preschool teachers' usage of DT are important in order to interpret why they underuse DT in ECE.

Though it was not examined in this study, another factor that may influence teachers' DT use is the children's age group (Bolstad, 2004; Kerckaert et al., 2015). According to the joint statement of the NAEYC and Fred Rogers Center (2012), appropriate usage of DT is relevant to the age, developmental level, background, and abilities of children. Therefore, a lack of difference seen according to age of children may signal overuse or underuse of DT in the classroom. Overall, it means that developmentally inappropriate use of DT may harm children. Research on different age groups and samples could provide deeper information in order to explore the reasons of indifferent DT use between the age groups of children.

Conclusion

Today, intense interaction between young children and DTs has become inevitable and cannot be overlooked in terms of their education. Furthermore, DT has the potential to positively affect the development of young children if used intentionally and appropriately to the child's age (NAEYC & Fred Rogers Center, 2012). Thus, the successful integration of DT into ECE can facilitate achieving the required scope of ECE.

Appropriate and successful integration of DT in early childhood settings can address the equity and access issues which may otherwise remain unresolved (NAEYC & Fred Rogers Center 2012), and which may result in gaps in terms of children's achievement, technology skill levels, and the beginning of digital literacy between children. Thus, early childhood educational settings should include essential forms of DT such as computers, digital cameras, projectors, printers, tablet computers, and even smartphones in order to provide opportunities for all children. Therefore, as the current study detected, televisions and computers are more readily available than newer forms of DT, and that Early childhood educational settings have issues related to the provision of DT hardware and software to enrich and support the learning and development of young children. Hence, issues of access and equity must be handled by the policymakers responsible for these areas. In addition, preservice and inservice early childhood teachers' awareness of the newest forms of DT should be supported so as to motivate them towards good practices of DT usage.

Providing a variety of forms of DT to early childhood teachers is inadequate in terms of the appropriate use of technology in the Early childhood educational setting. Inappropriate use of technology may emerge if the early childhood teacher does not know when and how to integrate technology (NAEYC& Fred Rogers Center, 2012) into the classroom. In particular, the passive use of technology may threaten active play and the interaction of young children. An activity in which children remain inactive is a poor example of DT integration in the ECE. Getting children to just watch cartoon films or to listen music is not considered an effective use of technology in the classroom. Developmentally appropriate and successful practices provide choices and also pass an element of control to the child. Teachers can then scaffold the children in their accomplishment of the assigned tasks. On the other hand, successful integration includes components such as training and appropriate skills usage.

Ertmer (1999) divided barriers to successful technology integration into two types. The first being environmental barriers, in that teachers do not use technology in their teaching because they are short of available time, lack the necessary training, access to technology, professional development, or the appropriate level of pedagogical and technical support. The second type of barrier includes teaching belief, attitude towards using technology in education, and teachers' ease with technology. Thus, the teachers' views, tendencies, and technical skills are of significant importance as they can affect the integration of DT in education (Hew & Brush, 2007). If early childhood teachers' use of DT in their teaching is analyzed according to the findings of the current study, it can be concluded that

Turkish early childhood teachers have access to DT in the physical classroom. Furthermore, they have positive attitudes towards the use of technology in ECE. However, their workload, preservice or in-service training, and the support provided to them may account for their limited usage of technology in their teaching. Therefore, further research is required in order to obtain a deeper level of information about the barriers faced by teachers for the successful use of DT in their teaching. In addition, presenting examples of good practice may be useful so as to inspire teachers to integrate DTs into the classroom that are developmentally appropriate and educationally valuable. Moreover, providing both preservice and in-service training on DT usage in the classroom, and the integration of DTs into ECE can support the professional development of ECE teachers.

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