TECHNOLOGY USE IN PRESCHOOL EDUCATION: A SYSTEMATIC MAPPING STUDY

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Abstract

The rapid expansion of technology into the worlds of young people has created a new generation which can use computers, mobile devices and other digital technologies as easy as winking. Nevertheless, in the context of early childhood settings there are some influences that may differentiate the technology use behaviors of preschool children which are generally constructed at home or school environment. This study seeks to define the possible influences, effects and praxis of technology use in early childhood settings, and also intends to explore the current research trends about technology use in the field of early childhood education. Data were gathered from several scientific databases. Research articles and other scientific documents/papers were reviewed in a systematic manner with content analysis approach. To increase reliability, four researchers who have the similar background in the educational technology field were participated in this study. Review of the articles and scientific documents were conducted in two rounds. Review process was repeated by two researchers different from the first round, and a different set of two researchers were cross-checked in the second round. This study also draws on a discussion about pedagogical effects of technology use in early childhood settings.

Keywords: Preschool education, early childhood education, technology use, preschool technologies.

1 INTRODUCTION

With the development and high availability of technology, the number of technology users is increased exponentially. The reports of Ofcom [19] showed that the ownership and the use of touch screen technologies such as smartphones and tablets are rapidly increasing and the age of technology users is decreasing. Children have become technologically literate in early ages [18]. In other words, children are accessing to variety of technologies and internet more at younger ages. For instance, in U.S in 2013, 38% of children at or under age 2 used mobile technological devices whereas 10% of them used in 2011 [6, p. 9]. Similarly, a study showed that in 2014, 83% of the children aged between 2 and 10 used high speed internet, 76% played with game console, 71% used smartphones and 41% accessed educational gaming device [22]. Children aged 5 and under use internet once a week if there is at their home and play games on variety of mobile devices such as laptops, smart phones and tablet PCs frequently [2]. Most of the parents of children between 4 and 7 years old gave their Iphones to their children and allowed them to play games on this device [4]. The report of European Union in 2013 demonstrates that in worldwide children go online in younger ages. In US, 25% of 3 year old children and 50% of 5 year old children connect internet in daily basis and 70% of 3-4 year old children use internet sometimes in Sweden. In another study conducted by Ofcom [19] showed that in U.K, 28% of the 3 and 4 years old children used tablet PCs at their home and 12% were allowed to access Internet via tablets. Additionally, 14% of their parents believed that their children knew Internet more than they do. The average age of Australian children who use internet first time is under 8 [13, p.7].

The touch screen devices offers interaction to the young children since it is very easy to use them compared to computers. Unlike computers which requires mouse or keyboard skills, young children can use this device easily due to its touch screen [14]. According to Radich [11] by using tools that become user-friendly, kids are doing a variety of activities such as playing a game, making a picture, recording a story or taking a photo [p. 6]. Additionally, mobile devices such as smartphones and tablets are more available to the children compared to computers in nearly 50% of which children are forbidden to use [14]. Holloway et al. [8] state that there is an increase in the availability of tablet computers for the young children age 6 and under by citing a report which demonstrates that in Sweeden 50% of the 3 and 4 age-year-old children use tablets and in Norway, 23% of the children at 6 and under use them. In 2011, 38% of the children under eight used mobile devices whereas in 2013 72% used it [6, p.9]. This situation also takes the interest of the companies and inspired them to develop special technologies for the young children. They designed technology in order to develop...
specific skills such as literacy skills of the young children and encourage their parents to buy them in order to develop the skills of their children [10]. As stated by Gutnick et al. [2] point out, educators and media developers state that as prices drop, more families will use these devices [p. 33]. Further, they note that if iTunes is not a market for children, an essential proportion of the pre-eminent 100 educational apps on iTunes involved in children’s content, [2, p.33]. But the ease of their use brings an important question about how and when these technologies should be served to the young children. This issue poses a modern-day dilemma to the parents [21] since their affordances and availability is increasing at homes of young children [16]. Hence it calls researchers to investigate when and how these technologies should be used in early education context.

A few literature reviews have been carried out on technology use in early childhood education. In the first literature review, McCarrick & Li [12] focused on research between 1984-2004. The subject of their research was effects of technology on social, cognitive, language development and motivation of children between three and five years old. In the second review, Lankshear & Knobel [5] focused on research from 1996 to 2002. The main theme of their study was the relationship between technology use and literacy skills of students up to the age of eight. The third review, conducted by Yelland [17] concentrated research from 1994 to 2004 with the subject of children up to the age of eight. The research has been examined in the following four contexts literacy, numeracy, creativity and critical thinking, and the creation of knowledge building communities.

The fourth review, Burnett [3] focused on the research carried out between 2003 to 2009. The review concentrated on technology and literacy and children up to eight years old. The fifth review conducted by Zomer [23] focused on research between 2009 to 2014. The researcher concentrated on effects of technology usage within the concept of learning and engagement in early childhood education of children from 3 to 6 years old.

Due to the aforementioned reasons, this study explores the researches about the use of technology in early childhood context. It aims to identify the possible influences, effects and praxis of technology use in preschool settings, and also intend to explore the current research trends about technology use in the field of preschool education and guide the families, researchers and practitioners about the technology usage of preschoolers. This study also shed light on the pedagogical effects of technology use in early childhood settings.

2 METHODOLOGY

This research is a systematic mapping study. Systematic mapping studies enable categorical screening for classifying published research. These studies are parallel to systematic reviews, but they use a broader criteria system to describe main subjects in related field, rather than synthesize study results [9]. Generally, systematic mapping provides a visual summary [20] or a map that guides the readers and researchers about a not well-known field of literature.

In this study, related resources about technology use in preschool settings, were examined in a systematic way with pre-defined criterias with time constraint. The study presented here covers peer-reviewed articles and conference papers for 5 year period that published between 2012-2016. 218 related papers about technology use in preschool settings were analyzed in the context of this research. Literature review was conducted through Google Scholar database and pre-defined keywords were searched in titles level only. Keywords used in mapping process were “preschool & technology”, “early childhood & technology”, “toddlers & technology”, “preschool & computer”, “preschool & tablet”, “early childhood & computer”, “early childhood & tablet”, “toddlers & computer” and “toddlers & tablet”. Papers found in this stage were primarily reviewed using their abstracts.

Irrelevant papers were determined and excluded from the analysis after their abstract sections basically reviewed by the researchers. For he analysis phase of the study the following exclusion criterias were used:

- Studies not directly related with the early childhood settings
- Studies about teachers improvement only
- Book chapters, book reviews, dissertations, concept papers, reflection papers, field notes, technical reports and documents, etc
- Papers in languages other than English;
For this study, only the research articles and conference papers were included for the final analysis phase. After exclusion of irrelevant studies in the final stage, a total of 77 papers as shown in Fig. 1 were selected and analysed according to pre-defined categories. Categories used in this study are; keywords, method, paper type, data gathering tools, dependent and independent variables, participants, technology used, data gathering environment, research contexts and the origin of the research. Methodology selection of research papers rooted to Creswell [7]. “When a study did not fit into the categories identified by Creswell, the name of the method that the writer of the article used was added into an existing category based on similarity of method with others in that category” [1].

To increase reliability of this research, review of the articles and scientific documents were conducted in two rounds. Review process was repeated by two researchers different from the first round, and a different set of two researchers were cross-checked in the second round. Interrater reliability of the reviewers were .90 and .95 respectively.

3 RESULTS

For this study, 380 scientific papers were examined. A total of 303 papers were excluded by the reviewers due to exclusion criteria. 77 articles and conference papers were included to descriptive analysis and examined based on the pre-defined categories.

3.1 Keywords Indicated

According to keywords indicated, researchers come up with an assumption that keywords in the studies provide “a holistic reflection” [1] of the research paper topics. Keyword-relevant finding of the research is based on a descriptive keyword analysis. In this study a total of 189 different keywords were indicated and ranked according to their frequency. Table 1 shows only the 34 of 189 most frequently used keywords from the papers. As can be seen in the table below, the most generic field specific term is “early childhood education” and “preschool” is generally used to define a specific developmental period of children.

When keywords analysed, it can be observed that there are some influential groups of components about technology use studies in preschool settings. First group consists of field specific terms and concepts as “early-childhood-education, preschool, young children, preschool teachers, etc”. Second group consists of educational technology use and technological devices as “educational technology, tablet computers, ipads, computers, smartphones, technological literacy, technology integration, ICT, augmented reality, developmentally appropriate technology, mobile technology etc”. Third group consists of organizational and environmental elements of early childhood education ecosystems as “caregivers, caregiver perspectives, early childhood curriculum, early childhood organisations, educational facilities, educational finance, family involvement, family role, family school relationship, parents, preschool curriculum, preschool staff etc”, fourth group consists of health and special education issues as “impaired children, health saving technologies, autism spectrum disorder, cochlear-implants/hearing aids, emotion understanding, occupational therapy, physical activity, well-being etc”.
### Table 1. Most used keywords.

<table>
<thead>
<tr>
<th>Keyword</th>
<th>n</th>
<th>f [%]</th>
<th>Keyword</th>
<th>n</th>
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</table>

Fifth group group consists of instructional/learning methods and strategies as “technology enhanced storytelling, video puzzle based learning, teaching methods, computer aided language learning, computer assisted instruction, computer assisted tutoring, home literacy activities, interactive playability etc.” Another significant group consists of possible variables of technology use in preschool settings that may have cause-effect relationship on learning. These are; “barriers, interaction, screen time, active play, aesthetics, creativity, gender, hand writing, literacy, language usage, attitudes, perceptions, self-regulation, social skills, visual perceptual skills, vocabulary knowledge, writing mediation, writing support etc”.

### 3.2 Types of Studies

The percentage of publication types of studies from 2012-2016 was calculated in total. As it seen in Fig. 2, field/area study, opinion-evaluation study, literature review, program-content review and field/area research are the main themes for publication types. The findings indicate that field/area study was the most conducted [60%] publication type in studies from 2012 to 2016. With the subject of publication type in studies, opinion-evaluation study (22%), literature review (7%) and program-content review (7%) were carried out in studies respectively.

![Figure 2. Publication types of studies from 2012-2016.](image-url)
3.3 Research methods and models

The percentage of research methods between 2012 and 2016 is presented in this section of the descriptive content analysis. In order to determine what kinds of research methods carried out by researchers, studies were examined in terms of qualitative, quantitative, mixed and N/A. The findings indicate that the researchers mostly preferred qualitative (47%) studies. Nevertheless, just a few mixed method (3%) studies conducted in research from 2012 to 2016.

![Figure 3. Percentage of Research Methods in studies from 2012-2016](image)

Another finding is about the research models conducted from 2012 to 2016. The research models are sorted by preference numbers in Fig. 4. According to findings, it can be noted that semi-experimental, non-experimental descriptive and case studies were mostly preferred research models.

![Figure 4. Research Models in studies from 2012-2016.](image)

3.4 Variables

Even if variables generally focus on the feelings, emotions, physical activity data and behaviour of the learners [1], the variables indicated in this research is far different from this statement. There were 144 diversified variables occurred in the study and 8 of them is repetitive. As can be seen in Table 2, the most used independent variable is technology (n=3) where the most used dependent variable is pre-schooler (n=7). Variables showed parallelism with keywords findings.
Table 2. Most used variables.

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3.5 Data collection instruments and participants

Data collection instruments are also examined in this study (Fig. 5). Within the scope of data collection the main themes are determined as survey, document analysis, interview, observation, scale, test and N/A. The findings were determined according to years and total number. Data collection instrument shows, in total, observation is mostly preferred in studies between 2012 and 2016. According to the total number, survey is the second most preferred data collection instrument. The findings also show that test is the least preferred instrument in studies.

![Figure 5. Data collection instruments in studies from 2012-2016](image)

Fig. 6 shows the classification by participants. According to the findings, in studies from 2012 to 2016, preschoolers were mostly preferred as research participants. However, parents were preferred in just a few studies. This finding is a remark that understanding childrens' world and learning environments is still a significant action for researchers.
3.6 Research scopes

Research scope of studies from 2012 to 2016 was also determined in this study. The main research scopes were examined as technology teaching, content-context instruction, medical applications and special education. As can be observed in Fig. 7, the most preferred research scope is content-context instruction in total number of studies from 2012-2016. Technology teaching, special education and medical application are the most widely conducted research scope in studies respectively.

3.7 Technologic devices and environments in which the data were gathered

In this study, the technological tools subjected in studies were identified. The main themes were determined as tablet, PC, general technology use, smart phone and smart-whiteboard. The percentage of technological tools was calculated separately for each year. According to the finding (Fig. 8), general technology use was the most preferred technological tools which were subjected in studies. Nevertheless, within the concept of technological tools, smart-whiteboard was subjected in just a few studies.
Another finding of this research is the environment in which the data were gathered. According to the findings, with the subject of data collection environment, school/classroom (65%) was the most preferred environment in studies. Literature reviews with no research environment (25%) was the second carried while house was the least preferred one.

3.8 Countries where researches were conducted

Fig. 10 shows the findings of where the studies were conducted. In this study, countries were sorted according to the number of studies. As seen in figure 10, studies between 2012 and 2016 were conducted in 19 different countries. The country, where the most of the studies were carried out is the USA (n=30) while the second preferred country is Sweden with just 8 studies. Other owner countries were Turkey, Australia, Malaysia, Russia, Indonesia, Kosovo, Scotland, Kenya, Taiwan, Belarus, Kazakhstan, Romania, Saudi Arabia, Nigeria, New Zealand, Israel and Netherlands.

4 CONCLUSIONS

The main purpose of this mapping study is to provide an overview of what has been investigated in preschool settings about technology use in the last years. To achieve this purpose, we followed a systematic methodology. Study intended to reveal the research trends between 2012 and 2016. According to results it can be concluded that preschool education field is a very comprehensive and interdisciplinary.

Most of the researches about technology use in early years education were designed as semi experimental, descriptive or case study models. This supports the view that preschool education field is a comprehensive field. It can be concluded that it is an ongoing process to fully understand the ecological structure of early years education. Additionally, we need studies examining the learning processes of children towards rapid expansion of technology. As a comprehensive and interdisciplinary field, researchers may use a variety of new technologies that adapt to learning or special needs of pre-schoolers. The power of technology will bring learning analytics for all, so it may be more feasible to prepare our children for the unexpected future.

This mapping study shows that there is no consensus between researchers about technology use in early years education. The number of empirical researches are limited so it is difficult to obtain a proper research trend about research area. But is observable that technology has a profound effect on home/class activities and most of the preschool teachers are pushing themselves to manage these techno-pedagogical effects.

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