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RESEARCH ARTICLE

Reinforcing preschoolers' phonemic awareness through the use of tablets

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Abstract: This study aimed to implement an intervention program to examine whether tablets enhance kindergarten children's phonemic awareness. Seventy-four (74) kindergarten children (40 boys and 34 girls) aged 4 to 6 years from 4 public kindergarten classrooms participated in the study, from which 38 children formed the experimental group while 36 children formed the control one. During the intervention program, children in the experimental group were trained through tablets in initial phoneme identification, initial phoneme deletion, and phoneme segmentation, while the control group was trained in the same tasks without tablets. Results showed statistically significant differences in favor of the experimental group. In conclusion, the present research found that digital media help educational practice, but it is also how teachers use digital tools to facilitate learning.

Keywords: digital literacy, phonemic awareness, tablets, preschool

1 Introduction

Digital media have extensively penetrated young children's everyday lives in Western societies (Fessakis et al., 2015; Papadakis, 2016), while digital literacy has been introduced in the educational policies of several developed countries (Papadakis & Kalogiannakis, 2017; 2019). Digital media and screens are ubiquitous in our daily lives, and children in today's world are digital natives. Digital literacy entails skills that involve the use and consumption of digital media, the act of processing and retrieving information, participation in social networks to produce and transmitting knowledge, and a comprehensive set of skills concerning the use of computers (Kontrovourki & Tafa, 2019). To define what digital literacy is, Gilster (1997, page 58) suggested that it is "the ability to understand and use multiple forms of information from a wide set of sources presented by computers." Through digital literacy, each student can expand technology in the classroom for creativity and self- expression. The integration of technology in education is predicated on science literacy, emphasizing a learning process based on the investigation (Kontrovourki & Tafa, 2019). The availability of affordable and portable smart devices provides the opportunity even to children under eight years from low-income family backgrounds to access smart mobile devices (smartphones - tablets) (Guernsey & Levine, 2016; Papadakis & Kalogiannakis, 2019). Besides, studies have illustrated that through the use of interactive touch screens and the participation in developmentally appropriate

educational activities, children develop skills and abilities that exceed the expected perceptual and motor skills development of their age, improving preschoolers' anticipated learning results (Kalogiannakis et al., 2018; Kalogiannakis et al., 2018). Many researchers advocate that if new interactive technologies are integrated into the daily educational process of the preschool classroom through developmentally appropriate applications and educational scenarios, they can play a fundamental role in attaining the objectives set by the Preschool Curriculum (Papadakis & Kalogiannakis, 2017).

2 Literature review

According to Porpoda (2002), phonological awareness is the language speaker's ability to transition from transparent to non-transparent elements of a language and acquire the awareness and ability to handle the basic structural units of phonemes. Similarly, Gombert (1992) suggests that phonological awareness is children's ability to recognize phonological parts of language units to use them naturally. Over the last few years, devices with interactive screens such as tablets are being used by more and more young children due to their multiple uses and the intuitive interconnection based on touch (Papadakis & Kalogiannakis, 2019). However, few

studies have been conducted on developing emerging literacy skills (Neumann, 2018) through such devices. The term emerging literacy refers to behaviors that precede and evolve along with traditional knowledge of literacy while at the same time the term is used to describe attitudes, knowledge, and skills related to decoding and understanding messages of written language as well as producing decoded messages during the preschool age, that is to say before the introduction of the systematic teaching of reading and writing skills (Papoulia & Tzelepi, 2004; Sivropoulou & Hatzisavvidis, 2004). Considering that children's interactions with applications allow them to assign meaning to various digital presentations, tablets can become potential learning tools for literacy (Dorouka et al., 2020). Children's emerging literacy skills can be considerably reinforced through images, symbols, letters, and words that appear on tablet screens (Neumann, 2018). According to Neumann (2018), which sought to investigate whether tablets facilitate the learning of the alphabet through the use of three different applications (matching, recognizing, and designing letters), children in the tablet group showcased more extraordinary ability in recognizing letter names and letter sounds than children in the control group. A concomitant study led by Kucirkova & Sark (2015) examined whether the capacities offered by both digital (iPad applications and computer software) and non-digital means (collage and designing) facilitate the production of texts in children aged one to three years and whether they influence creative expression during the collaborative production of texts with fathers at home. The results illustrated that digital media are conducive to children's creativity. However, children's interaction with the adult parent assumes an essential role in developing their creativity.

Oakley et al. (2018) investigated whether the production of digital multimodal texts through tablets and open-ended creative applications contributed to the development of literacy in children aged five in two schools located in Western Australia with low socioeconomic backgrounds. Gozum & Demir (2021), who participated in the study, were trained to use applications that sought to get children involved in producing multimodal texts and improving their literacy skills. Before and after the intervention, the scores showed an improvement in children's reading skills who participated in the study. Besides, teachers noted some improvement in children's oral, written as well as reading skills.

Carson (2020) investigated the effectiveness of mobile applications for literacy in 4-year old's with a developmental language disorder and low reading skills. This pretest/posttest study between groups showed significant improvements in phoneme mixing and segmentation and linear sound knowledge among experimental children who received instruction with Reading Doctor applications compared with control children who received standard emerging instruction. These findings show that mobile applications have the potential to improve students' phonological awareness. An initial search using terms related to two basic literacy skills ("voice" and "phonological awareness") yielded approximately 2,933 apps in the App Store and 4,128 apps in the Google Play Store (Griffith et al., 2020).

Consequently, studies prove that new technological means can positively impact literacy skills provided there are appropriate literacy applications and the proper use and guidance on the part of educators.

3 Research Methodology

This current study aims to examine whether digital media and, more specifically, tablets are conducive to developing phonemic awareness in preschool-age children. The sample of this study was taken from the population of preschool educational establishments in the Chania district (Petousi & Sifaki, 2020). In particular, the sample of this study comprised 74 children of preschool age (4-6 years), 40 boys and 34 girls. Through convenience sampling, children, who attended two public preschool educational establishments during the academic year of 2018-2019 in the Chania district, were chosen to participate in the study. For this study, two groups were formed, the experimental group and the control group. The experimental group was trained in phonemic awareness through tablets, whereas the control group was trained in phonemic awareness without using tablets, that is to say, through conventional teaching methods. The children were assessed based on their intellectual abilities through the Raven Coloured Progressive Matrices test, customized and standardized in the Greek language (Sideridis et al., 2015). The mean score of subjects' IQ in the experimental group was M = 13.66 and the standard deviation SD = 4.06, while the mean score of subjects' IQ in the control group was M = 12.22 and the standard deviation SD = 3.86, respectively. Such a comparison showed a statistically negligible difference between the total mean scores of the subjects in the two groups ($t = 1.56$, $p = 0.124$).

The children from the two groups were assessed based on three different criteria before and

after the intervention. The criteria were: a) Initial Phoneme Identification (IPI) test (Manolitsis, 2000) through which children's ability to recognize whether two words have the same initial phoneme or not was assessed b) Phonemic Segmentation test which assesses children's ability to break a word into the phonological units which make it up, the phonemes (Manolitsis, 2000) and c) The Phoneme Deletion (PD) test which assesses children's ability to utter a word without its first phoneme (Manolitsis, 2000).

3.1 Intervention Process

During the first day of the intervention, children in the experimental group were trained in Initial Phoneme Identification (IPI) designed by the researcher through Adobe Flash Professional CS6 software. In the first activity done through tablets, children were asked to find the common initial phoneme of a word. In particular, the instructions provided by the portable application were: "find the name of the image that starts with the same sound as the beginning sound of the word plane and click on it." It should be noted that the "target" image was designed with prominent colors and was highlighted to stand out from the rest of the images. The images that appeared at the bottom part of the tablet screen were four correct and three incorrect (Figure 1). A sad face appeared by clicking on the incorrect image, saying to children, "try again, and you will make it." The child was given another chance to try and think again by listening once again to the instructions provided. A happy face appeared, saying to the child, "well-done you made it," and the child could proceed to the next activity by responding correctly (Figure 2). In the second activity, which took place during the first day of the intervention, children responded with a yes or no on whether two images had the same initial sound. The instructions provided to children on their tablets were "Do the words frog and violin start with the same sound? Yes, or no?". In the case in which the child responded incorrectly, a face would appear saying to him or her, "try again, and you will make it," whereas in the case in which the child responded correctly, a happy face would appear saying "well-done you made it" and the child could proceed to the next instruction.

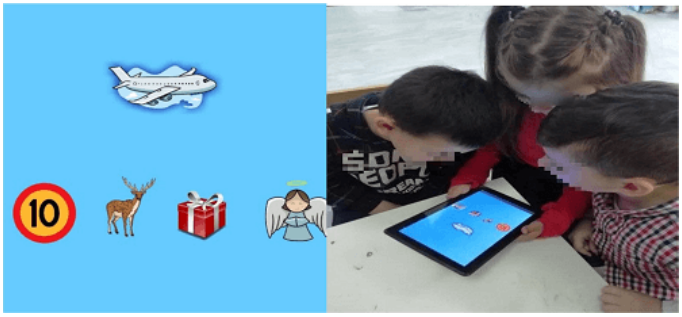

Figure 1 Identification of common initial phonemes

On the second day of the intervention, during their first activity, children were trained in initial phoneme identification (IPI) as they were asked to respond to the instruction "What is the name of the image which starts with the same sound as the beginning sound of the word (*e.g.*, love)?" The child viewed only four images; e.g., the word love was not displayed in any image. It was merely heard, and at the bottom part of the screen, four images appeared, three of which were incorrect and one correct. If the child responded incorrectly, a face would appear saying to him or her, "try again, and you will make it," whereas if the child responded correctly, a happy face would appear saying, "well-done you made it," and the child could proceed to the next instruction. In the second activity done on the same day, the children were preoccupied with initial phoneme deletion. More specifically, the instruction provided to children was "which word would be created if we removed from the word palace the first sound?" Click on the correct image. The children could view the image of a palace at the center of the screen with bright colors flickering to make the image stand out from the rest at the bottom. More specifically, children could view the words on their tablet screens in images in this activity, with one image being correct and three being incorrect (Figure 3). If the child responded incorrectly, a face would appear, saying to him or her, "try again, and you will make it," whereas if the child responded correctly, a happy face appeared saying, "well-done you made it," and the child could proceed to the next instruction (Figure 4).

During the third day of the intervention, in the first activity, children had to replace the first phoneme in a word with a different phoneme to find which word was formed. The instruction that children were listening to on their tablet screens was: "Which word do we form if we

Figure 2 Initial phoneme

Figure 3 Isolation phoneme

Figure 4 Initial phoneme deletion

replace in the word sole the s with k? Click on the right picture." There were four images, three being incorrect and one being correct (Figure 5). If the child responded incorrectly, a face appeared saying to him or her, "try again and you will make it," whereas if the child responded correctly, a happy face appeared saying, "well-done you made it," and the child could proceed to the next instruction (Figure 6). The following activity on the same day of the intervention was forming a word from individual phonemes. The child listened to a narrator on the tablet who was slowly dictating each phoneme of a word. Then the child had to

recognize which word the narrator said. It should be noted that all the words were composed of four phonemes and had the structure CVCV.

Figure 5 Initial phoneme and substitution

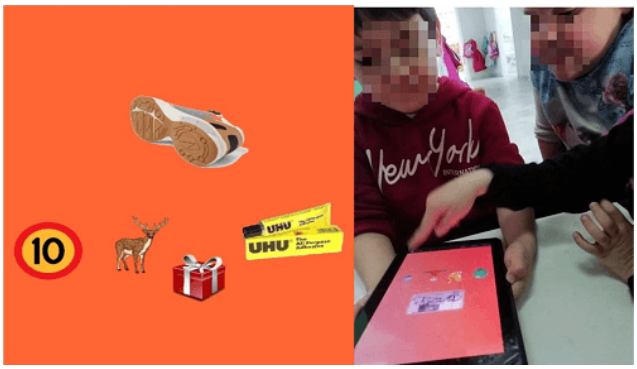

Figure 6 Initial phoneme deletion and substitution

In the control group, children were trained in phonemic awareness without the use of tablets. Akin to the experimental group, the intervention program of the control group lasted three days, and the researcher implemented the children's training in three consecutive days while the activities and the images were the same, the sole difference being the fact that children did the activities without the use of tablets.

After ten days had passed since the completion of the intervention, all children who participated in the study were assessed again based on the phonemic awareness criteria and, more specifically: The Initial Phone Identification (IPI) criterion, the Phoneme Segmentation (PS) criterion, and the Phoneme Deletion (PD) criterion.

4 Results

Figure 7 shows the absolute and relative frequencies for the children's group, sex, and age in the sample. The research sample consisted of 74 children, of which 40 were boys, and 34 were

girls. Of the 74 children, 38 (22 boys and 16 girls) formed the experimental group, while the 36 children (18 boys and 18 girls) formed the control group. Of the 74 children, 38 children were 5-6 years old. From the experimental group, the total number of children aged 5-6 years was 18 children, while from the control group, there were 20 children. The total number of children aged 4-5 years was 36, were of these, 20 were in the experimental group and 16 in the control group.

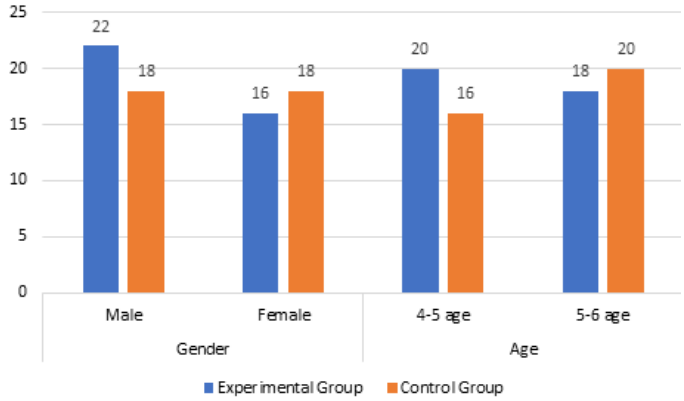

Figure 7 Absolute values in the group, gender, and age

Table 1 illustrates the mean scores, standard deviations, and the minimum and maximum scores of children's performance in both the experimental and control groups assessed on Initial Phoneme Identification, Phonemic Segmentation, and Phoneme Deletion before and after the intervention.

Table 1 The children's performance in both the experimental and control groups

Testing	Variable	Experimental Group						Control Group				
		M	SD	min	max	t-test	Df	M	SD	min	Max	t-test
Pre-Experimental Testing	IPI	6.29	2.967	1	10	0.48	72	5.22	2.674	0	10	0.44
	PS	13.5	9.709	1	40	1.57	72	11.42	8.08	0	35	1.34
	PD	2.32	3.077	0	10	0.49	72	1.64	2.332	0	8	0.38
Post-Experimental Testing	IPI	8.82	1.574	5	10	0.25	72	7.56	2.171	3	10	0.36
	PS	27.55	8.395	15	40	1.36	72	17.89	10.844	6	40	1.8
	PD	7.34	2.096	4	10	0.34	72	5.31	2.745	1	10	0.45

Note: Mean Scores (M), Standard Deviations (SD), minimum (min) and maximum (max) scores of the children's performance in the experimental and control groups on Initial Phoneme Identification (IPI), Phonemic Segmentation (PS), and Phoneme Deletion (PD) before and after the intervention.

Table 1 shows the pre-experimental testing on Initial Phoneme Identification (IPI) in the experimental group M = 6.29 and the control group M = 5.22. According to Table 1, the difference in the total mean scores of children's performance during the pre-experimental testing on IPI is statistically unimportant (t = 0.44, p = 0.11). In the same vein, the mean score of children's performance in the experimental group tested on Phonemic Segmentation (PS) was M = 13.50, while the mean score of children's performance in the control group was M = 11.42 respectively. According to Table 1, the difference in the total mean scores of children's performance during the post- experimental testing on PS is statistically unimportant (t = 1.44, p = 25). Finally, when assessed on Phoneme Deletion (PD), the mean score of children's performance in the experimental group was M = 2.32, and the mean score of children's performance in the control group was M = 1.64, respectively. According to Table 1, the total mean score of children's performance in both the experimental and control group during the pre-experimental processes performed to assess the independent variables of the study showed no statistically significant difference given that during the equality test of the two mean scores, the indexes t-test were relatively low. Therefore, both groups are considered equivalent regarding the subjects' performance in the abilities mentioned above and skills are concerned.

During the post-experimental testing, the experimental group's mean score on IPD was M = 8.82, while the control group's mean score was M = 7.56, respectively. The difference in children's total means scores during the post-experimental stage on IPI was statistically unimportant (t = 0.36, p = 0.05) even though the experimental group has the edge over the control group. As for Phonemic Segmentation during the post- experimental testing, the children belonging to the experimental group had a mean score of M = 7.34 while the children belonging

to the control group had a mean score of M = 5.31. According to Table 1, the difference in children's total mean score during the post-experimental stage is statistically significant (t = 0.45, p = 0.01).

Figure 8 illustrates the pre-experimental and post-experimental testing of both the experimental group and the control group on Initial Phoneme Identification (IPI), Phonemic Segmentation (PS), and Phoneme Deletion (PD).

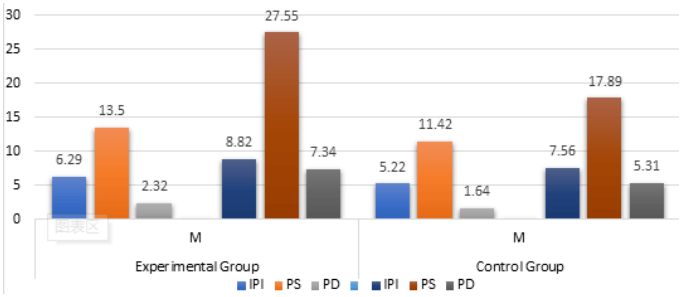

Figure 8 Mean Scores (M) of children's performances in the experimental group and the control group on Initial Phoneme Identification (IPI), Phonemic Segmentation (PS) as well as Phoneme Deletion (PD) before and after the intervention.

5 Conclusions

This current study aimed to examine whether the combined use of tablets and appropriate educational applications facilitates preschoolers' phonemic awareness. The educational intervention illustrated that children trained through the aforementioned digital media showed considerable difference in segmenting words into separate phonemes compared to the control group. Likewise, children belonging to the experimental group showed considerable differences in their performance on Initial Phoneme Deletion compared to the control group, whereas the experimental group performed better on identifying common initial phonemes than the control group. Nevertheless, there was a negligible difference between the two groups. Based on the current study as well as previous studies that have been conducted (Dorouka et al., 2020; Kalogiannakis et al., 2018; Neumann, 2018), it becomes evident that the proper use of modern portable technologies as teaching tools can have a positive impact on preschoolers' teaching and learning process. When children employ portable devices and developmentally appropriate educational applications, they generally exhibit better learning results negligible attributed to increased motivation, enthusiasm, interest, participation, independence, self-regulation, and creativity, all of which are reinforced through such media. Besides, it was observed that children who own tablets did not make any noise concerning other studies.

On the contrary, they discussed with their classmates to find the correct answer perceiving the learning process as a game (Kalogiannakis et al., 2018). Nevertheless, it should be noted that the use of any device on its own cannot supersede the role of the educator. On the contrary, the educator's proper guidance is a decisive factor in contributing to the student's active participation and the overall success of the educational process (Cohen, 2011).

Similarly, during the intervention process, it was established that children belonging to the experimental group enjoyed the process as their facial expressions showed interest, satisfaction, and enthusiasm while they were using the portable applications. It should be noted that they expressed their surprise and confusion by making exclamations and posing different questions to their classmates and themselves when they had to choose the correct answer. Indicative questions are the following "we have to think is this the correct answer? Think ppplane we need to find a word whose beginning sound is a, what about an angel?" Similar studies suggest that tablets provide increased learning motivation to students and render the learning process more entertaining and exciting as children are involved in a new way of learning with minimal effort and at their own will (Papadakis et al., 2018, 2019).

Many educators (Gözüm, & Kandır, 2021) and parents acknowledge the possible benefits of young children's use of technology (Kalogiannakis et al., 2021). However, they do not have the appropriate educational knowledge at their disposal to make proper use of it (Papadakis et al., 2017; 2021). Following a post-analysis of the applications, Dubé, Alam, Xu, Wen, and Kacmaz (2019) concluded that researchers need to stop wondering whether tablets constitute proper educational tools and instead focus on developmentally appropriate applications to maximize the learning benefits that stem from their use. In conclusion, when used in both formal and

informal learning environments, technology ought to be used in ways that promote children's learning and healthy development (Lee, 2016).

6 Discussion

This study aimed to examine whether digital media help preschool children develop phonemic awareness, which showed that children who practiced using digital media showed statistically significant differences from children in the control group regarding the division of words into individual phonemes. This is because children have increased motivation, more enthusiasm, interest, participation, independence, self-regulation, creativity are just some of the positives mentioned when children use tablets as they belong to the generation of digital media (Drolia et al., 2020; Kalogiannakis et al., 2021). One of the limitations of this research is that the research could have been applied to a larger sample of preschool children and not only in the prefecture of Chania. Other areas could also be considered, such as eliminating the final voice and recognizing letters in a later study, as it would be interesting to see if the tablets would positively affect children. At a later stage, it would be helpful to conduct a study similar to the present research hypotheses in a larger sample of children of the same or younger age who attend kindergarten for a more extended period and examine other parts related to children's phonemes. In this way, the results will be explored in different populations, and other more essential results may emerge. Besides, more complex phonological awareness cultivation activities could be included in future research. Simultaneously, the study results could be combined and extended to other areas of education, such as the management of attention deficit and hyperactivity disorder in preschool children.

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