IOJPE

ISSN: 1300 – 915X
www.iojpe.org

International Online Journal of Primary Education *2022, volume 11, issue 2*

THE EFFECT OF THE 5W1H TECHNOLOGY MODEL ON SOME VARIABLES RELATED TO READING SKILLS IN PRIMARY SCHOOL

Cengiz KESİK
Assist.Prof.Dr., Harran University, Faculty of Education, Department of Primary Education, Urfa, Turkey
ORCID: https://orcid.org/0000-0001-9777-0076
cengiz_kesik@hotmail.com

Ozlem BAS
Assoc.Prof.Dr., Hacettepe University, Education Faculty, Department of Elementary Education, Ankara, Turkey
ORCID: https://orcid.org/0000-0002-0716-103X
dr.ozlembas@gmail.com

Received: August 06, 2022 **Accepted:** December 17, 2022 **Published:** December 31, 2022

Suggested Citation:
Kesik, C., & Bas, O. (2022). The effect of the 5w1h technology model on some variables related to reading skills in primary school. *International Online Journal of Primary Education (IOJPE), 11*(2), 338-360. https://doi.org/10.55020/iojpe.1158631

Abstract

The main purpose of this research is to examine the effect of the technology integration model-based application example on some reading variables of primary school freshmen. For this purpose, the research was designed in a single-group post-test weak experimental design and a single-group pre-test-post-test weak experimental design. The study group of the research consists of 30 freshmen studying in a branch of a primary school at the middle socioeconomic level determined by criterion sampling method. Dependent t-test and descriptive statistics analysis were used in the analysis of the research data. The application example based on the technology integration model has been effective in the development of phonological awareness skills of primary school freshmen, their transition time to reading, and their reading speed and levels on paper and screen. It was determined that primary school freshmen made fewer reading errors in reading on screen than reading on paper, and the students' reading levels from the screen were better. It was determined that students' attitudes towards reading were quite high.

Keywords: Integration model, literacy, phonological awareness, reading speed, reading level.

INTRODUCTION

Educators who conduct studies on students who are defined as children of the digital age need to carefully plan the use of technology that naturally attracts and motivates them. Güneş (2013) states that children start playing educational games, watching educational broadcasts and television, using the internet and computers at the ages of 2-3 and that they learn to receive various information and messages very easily using these tools. In studies carried out on children's use of technology, it has been found that children under the age of five are heavy users of a range of digital technologies at home, that more than 60% of children under the age of three interact with digital technologies, that 23% of these children use television, computer, and internet, that 20% can multitask while using technology (Palaiologou, 2016) and that children under the age of eight also spend an average of 43 minutes on the mobile phone daily (Johnson, Adams, & Cummins, 2012). Dewey (2013) states that the child should be at the centre of education and the education and instruction to be provided should be designed according to the child's interests, level, and needs. He argues that an education that does not interest the child will be meaningless for him/her and thus he/she may show resistance to learning. For this reason, integrating technology into the first literacy teaching process, which is the first step in the learning journey of children, will make the learning process more enjoyable and provide permanent and meaningful learning.

It is the teachers who will discover the interests of children and provide teaching suitable for their level. Dewey (2013) points out that if teachers fail in their discovery and the provision of the content

suitable for children's level, learning will not take place. During the initial literacy development process, teachers should be able to create the content suitable for children's level and systematically integrate technology into this process to offer interesting experiences for children so that the interest of children can be aroused. For teachers to be able to do these, they need to know the characteristics of primary school children, learning theories and methods and techniques to be used in the initial literacy teaching; moreover, they should understand how to integrate technology into education and instruction and how to perform this integration in practice.

Theoretical Framework

According to Vygotsky's social constructivist learning theory, technology can provide visual teaching support to help children understand complex concepts, and according to Dewey's educational philosophy, children will combine real-world applications and abstract concepts through visual presentations provided by technology (as cited in Roblyer & Doering, 2014). With this visual teaching support provided by technology, it is thought that children will be able to feel the sounds, which is the beginning of the initial literacy teaching, to learn the letters corresponding to these sounds and how to combine them to create syllables and words and to read and write sentences and texts constructed through the meaningful ordering of words rather than just sounding them because they will be able to see the concrete counterpart of everything they sound, read and write with the aid of visual support and presentations. This visual presentation and teaching support provided by technology integration will enable first-grade children who are in the concrete operational stage according to Piaget's theory of cognitive development to learn reading and writing in a shorter time and in a meaningful way in the initial literacy teaching process.

Systematic integration of technology into the initial literacy teaching process is thought to be possible with technology integration models. Technology integration models shed light on how to handle the integration of technology. Usluel, Özmen, and Çelen (2013) stated that the integration process is a multidimensional and dynamic process, and it includes many variables such as teacher competences, individual competences, curriculum, education policies, technological infrastructure, and parents. In the study conducted by Özmen, Koçak Usluel, and Çelen (2014), it was seen that the studies on information technology [IT] integration were mostly focused on the context of "factors affecting integration" because the elements in the integration process are like pieces of a puzzle, they complement each other and when they all come together, a beautiful image is formed. Selection of the suitable environment for the content to be taught, time and IT was as much important as bringing these elements together because the accomplishment of the integration process, which aims to improve the learning process, is possible by selecting the appropriate IT for learning situations and then ensuring the permanence and sustainability of the process (Usluel & Yıldız, 2012). The active use of IT in the learning and teaching process has a significant impact on the development of students' reading, writing, math, and science skills (Zheng, Warschauer, Lin, & Chang, 2016).

The integration of technology into learning and teaching processes is provided systematically with technology integration models. One of these models is the 5N1H technology integration model. The 5W1H (What, Why, Where, When, Who, How) Technology Integration Model is a model developed by Haşlaman, Mumcu, and Usluel (2008) to improve student's learning and evaluate the information technology [IT] integration process. In the model, which has a cyclical structure, the questions of who, why, and how to integrate are the basic questions, and the questions of what, when, and where are under the question of how to integrate (Figure 1). The question "Why to integrate" states the purpose of the integration process. The answer to this question focuses on student learning in terms of pedagogy, technology, and content consistency. Concerning the question "For whom to integrate?", it can be said that the subject of the integration of IT into the educational and instructional process is students. Therefore, it is important to define the characteristics of the students in the target group. The question "How to integrate?" seeks an answer to how to use the determined IT resources and applications with teaching methods and strategies to create and maintain learning environments suitable for the characteristics of the in the target group and the targeted objectives. The question "What to integrate?" is related to which IT resources teachers and students will use. The question

"Where to integrate?" concerns the place of integration such as laboratories, homes, libraries, science centres, and museums. The question "When to integrate" seeks an answer to when to use IT resources and applications for effective lesson planning and integration of IT into the teaching-learning process.

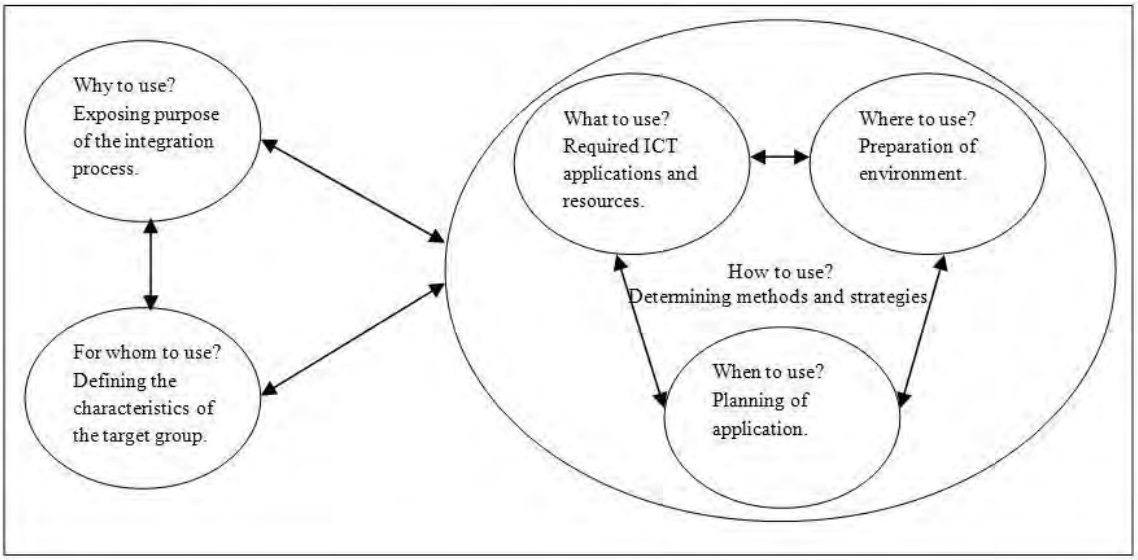


Figure 1. 5W1H technology integration model

It is an observed fact that technology is a part of our daily life and children are interested in technology in daily life. Due to the high interaction of children with technology, it is thought that it is necessary to systematically integrate technology into the initial literacy teaching process and environments, which may affect their academic life and future. Chauhan (2017) argues that if technology is extensively associated with pedagogy, it can be a powerful tool in the learning process of students.

Literature Review

When the literature on literacy teaching and technology integration is examined, it is seen that the visuals of sounds, syllables, and words in digital environments increase students' comprehension levels, improve their success in recognizing sounds, increase their reading speed, facilitate learning and support permanent learning (Açıkalın, 2018; Connor, Day, Zargar, Wood, Taylor, Jones, & Hwang, 2019; Ertem, 2014; Orhan Karsak, 2014a; Güneş, Uysal, & Taç, 2016; Gürol & Yıldız, 2015; Kesik & Baş, 2021; Özdemir, 2017; Taşkaya, 2010; Uğurlu, 2009; Zipke, 2017). It has also been concluded that electronic textbooks, educational software, and interactive boards support the recognition of sounds, letters, and reading texts with visuals and sounds, enable interactive education and that the computer can be a good tool for reading (Açıkalın, 2018; Ertem, 2014; Duran & Ertuğrul, 2012; Orhan Karsak, 2014a; Güneş, Uysal, & Taç, 2016; Kesik & Baş, 2021; Luo, Lea Lee, & Molina, 2017). It has also been determined that reading problems can be eliminated, teaching can be individualized and reading motivation can be improved by using technological tools and software (Açıkalın, 2018; Ertem, 2014; Taşkaya, 2010). Some other results reported in the literature are that primary teachers are willing and think that it is necessary to use digital technologies in Turkish and initial literacy teaching activities; yet, problems such as lack of hardware and software, not knowing how to integrate technology into the teaching process, difficulties in classroom management, teachers' professional experience and having seminars or training on the integration of technology affect technology integration and that the existing educational software should be arranged by the level and purpose of teaching (Duran & Ertuğrul, 2012; Ertem, 2016; Orhan Karsak, 2014a; Kartal, Baltacı Göktalay, & Sungurtekin, 2017; Özerbaş & Güneş, 2015).

It is thought that there is a need for an application-based study that will systematically integrate technology into the initial literacy teaching process and bridge the gap between theory and practice. In line with this need, within the scope of this research, answers were sought to the questions of why/who/how/what/where/when technology integration would be achieved in the first literacy

teaching process. Based on these questions, an application example based on the 5W1H technology integration model was designed and used because it allows for a structure where teaching activities are carried out systematically in the classroom and out-of-class environments. Besides, teacher-parent-student communication and interaction are ensured, and students' literacy skills can be followed easily. The use of the application sample prepared based on the technology integration model in the first literacy teaching process is believed to be a guide in the design and development of technology-supported environments in the context of the development of children's first literacy learning and skills, and contributes to the identification and elimination of the problems encountered in the implementation process. In addition, with this research, it is seen that not only the development of children's literacy learning skills, but also their digital skills can develop, that children can be prevented from learning to read and write incorrectly in out-of-class environments, that teachers can systematically integrate digital technologies into the first literacy teaching process, and that parents can help their children in the first literacy teaching process. The current study aimed to design a sample application based on the 5W1H technology integration model to apply in the initial literacy teaching process and to determine the effect of this model-based sample application on some reading variables. To this end, the study seeks answers to the following questions:

What are the effects of the sample application developed based on the 5W1H technology integration model to be conducted in the initial literacy teaching process in the primary school first-grade Turkish lessons;

1. on the development of phonetic awareness skills?
2. on the process of transition to reading?
3. on the speed and level of reading from paper and screen?
4. on the errors of reading from paper and screen?
5. on the attitudes towards reading?

METHOD

The purpose of the current study is to determine the effects of a 5W1H technology integration model-based sample application on some variables related to the reading skills of primary school first-grade students. In this connection, the weak experimental design, one of the quantitative research models, was preferred in the collection, analysis, and interpretation of the data. The weak experimental design is a design used when very few of the threats to internal validity can be controlled (Christensen, Johnson, & Turner, 2015). In the current study, the single group posttest weak experimental design and single group pretest-posttest weak experimental design were used together to determine the effect of the sample application based on the 5W1H technology integration model on some variables related to primary school first-grade students' reading skills. Within the purpose of the current study, the weak experimental design is deemed to be more appropriate as it is not possible to fully control all the variables that are not under investigation (McMillan & Schumacher, 1997). The reason why there is no control group in the study is that the study was carried out during the Covid-19 pandemic. In this process, it is very difficult to find a control group not subjected to technology-supported applications.

Focus Group

The study group of the current research is comprised of 30 first-grade primary school students attending one of the classes of a primary school in the central district of Haliliye in the city of Şanlıurfa, Turkey, in the winter term of the 2020-2021 school year. In the determination of the study group, criterion sampling was preferred. Criterion sampling is one of the purposive sampling methods. Patton (1987) states that probability-based sampling provides significant benefits in making valid generalizations about the population through representation, while purposive sampling allows for an in-depth study of situations that are thought to have rich information. The criteria used in the selection of the participants of the current study were their attending a school of a medium socio-economic level, their having devices to connect to the internet (computer, tablet computer, or mobile phone) and their having an internet connection (home internet or mobile phone internet).

The ages of the students in the focus group, as of September 2020, range from 68 to 80 months. Considering the average monthly income of the parents of the students, 12 of them have an average monthly income of 2 thousand TL and below, 6 of them between 2 thousand and 3 thousand TL, 2 of them between 3 thousand and 4 thousand TL, and 10 of them have an average monthly income of 4 thousand TL or more. When the educational status of the mothers of the participant students is examined, 11 of the mothers are primary school graduates, 3 of them are secondary school graduates, 11 of them are high school graduates and 5 of them are university graduates. When the father's education level is examined, 6 of the fathers are primary school graduates, 2 are secondary school graduates, 12 are high school graduates and 10 are university graduates. While 13 of the students have a computer at home, 17 of them do not. While 29 mothers and 26 fathers have mobile phones, 1 mother and 4 fathers do not. In total, 27 of them have the internet on their parents' mobile phones, while 3 of them do not. While 14 of the students have an internet connection at home, 16 of them do not. While only 13 of the participants use the Internet for their course activities, the rest use the Internet for different purposes in various amounts, as well.

Experimental Application

As it is not possible to fully control all the variables in the research, it is thought that choosing a weak experimental design is a more accurate choice (McMillan & Schumacher, 1997). The reason for the lack of a control group in the study is that the research practices were carried out during the Covid-19 epidemic; therefore, in this process, it is very difficult to find a control group without technology-supported applications.

Before the application, the Early Literacy Skills Assessment Tool was applied as a pre-test. Later, lessons were organized based on the 5W1K technology integration model during the first literacy teaching process for 18 weeks, and in the independent literacy process for 3 weeks. During the application process, the researchers were in the classroom as an observer, and the applications were made by the teacher. At the end of the experimental process, the texts used with the Early Literacy Skills Assessment Tool in the pre-test were read to the students, and the Transition Time to Reading Form, Reading Speed Form, Error Analysis Inventory, and Attitude towards Reading Scale were applied as the post-tests.

In the experimental designs applied in the study, the dependent variables were determined as primary school freshmen students' phonological awareness skills, transition times to reading, reading speed from paper and screen, their levels and errors, and attitudes towards reading. The independent variable whose effect on these determined dependent variables is examined is an example of an application based on the applied 5W1H technology integration model.

Data Collection Tools and Analysis

The tool by which the data were collected within the scope of the current study is stated next to the relevant problem statement and explained in Table 1.

Table 1. Research problems, data collection tools, and analysis methods

Research Problems	Data Collection Tools	Analysis Methods
What is the effect of the sample application developed based on the 5W1H technology integration model to be conducted in the initial literacy teaching process in the primary school first-grade Turkish lessons;		
1. on the development of phonetic awareness?	Early Literacy Skills Evaluation Tool [ELSET]	Dependent Samples t-test
2. on the process of transition to reading?	Form of Transition to Reading	Descriptive Statistics
3. on the speed and level of reading from paper and screen?	Reading Speed Form Error Analysis Inventory	Descriptive Statistics
4. on the errors of reading from paper and screen?	Error Analysis Inventory	Descriptive Statistics
5. on the attitudes towards reading?	The Scale of Primary School Students' Attitudes towards Reading	Descriptive Statistics

In the current study, to collect data for the first research question, the Early Literacy Skills Evaluation Tool [ELSET] developed by Karaman (2013) was used; to collect data for the second research question, the Form of Transition to Reading developed by Kesik (2021) was used; to collect data for the third and fourth research questions, the Reading Speed Form developed by Kesik (2021) and the Error Analysis Inventory developed by Ekwall and Shanker and adapted to Turkish by Akyol (2020) were used; to collect data for the fifth research question, the Scale of Primary School Students' Attitudes towards Reading developed by McKenna and Kear (1990) and adapted to Turkish from English by Kocaaslan (2016) was used.

The data collected with the Reading Speed Form, the Form of Transition to Reading, the Early Literacy Skills Evaluation Tool, the Error Analysis Inventory, and the Scale of Primary School Students' Attitudes towards Reading were analysed by using the SPSS 22.0 program package. In the analysis of the collected data, dependent samples t-test and descriptive statistics were used. The obtained findings are explained with tables and graphs in the findings section.

A sample application based on the 5N1H technology integration model

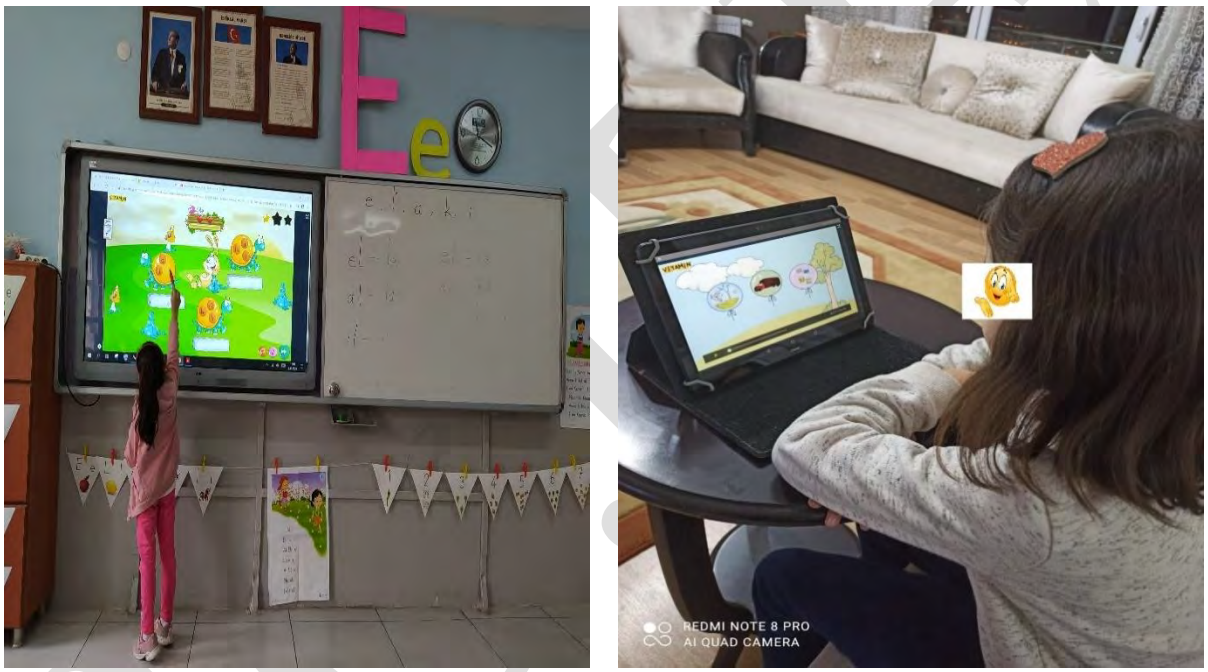


Figure 2. Visuals from the application

In the current study, a sample application based on the 5W1H technology integration model was designed to apply in the initial literacy teaching process. In the designed sample application, each sub-question of the 5W1H technology integration model was answered according to the variables of the initial literacy teaching. The answers to the questions of why to integrate, for whom to integrate, how to integrate, what to integrate, where to integrate, and when to integrate into the initial literacy teaching are respectively as follows: The reason for the integration in the initial literacy teaching is to perform the integration of technology into the teaching process in a systematic way and to determine its effect on children's reading skills. Moreover, it is to present a sample application based on a model of technology integration in the initial literacy teaching so that the gap between theory and practice can be closed. The integration in the initial literacy teaching process included children aged 69 months and over, and their primary teachers and parents. In the initial literacy teaching process, integration was carried out with different learning activities based on active and web-based learning, where interaction and communication were intense, including homework from printed materials and online assignments, and reading exercises from printed materials and on-screen.

IOJPE
International Online Journal of Primary Education
ISSN: 1300 – 915X
www.iojpe.org
2022, volume 11, issue 2

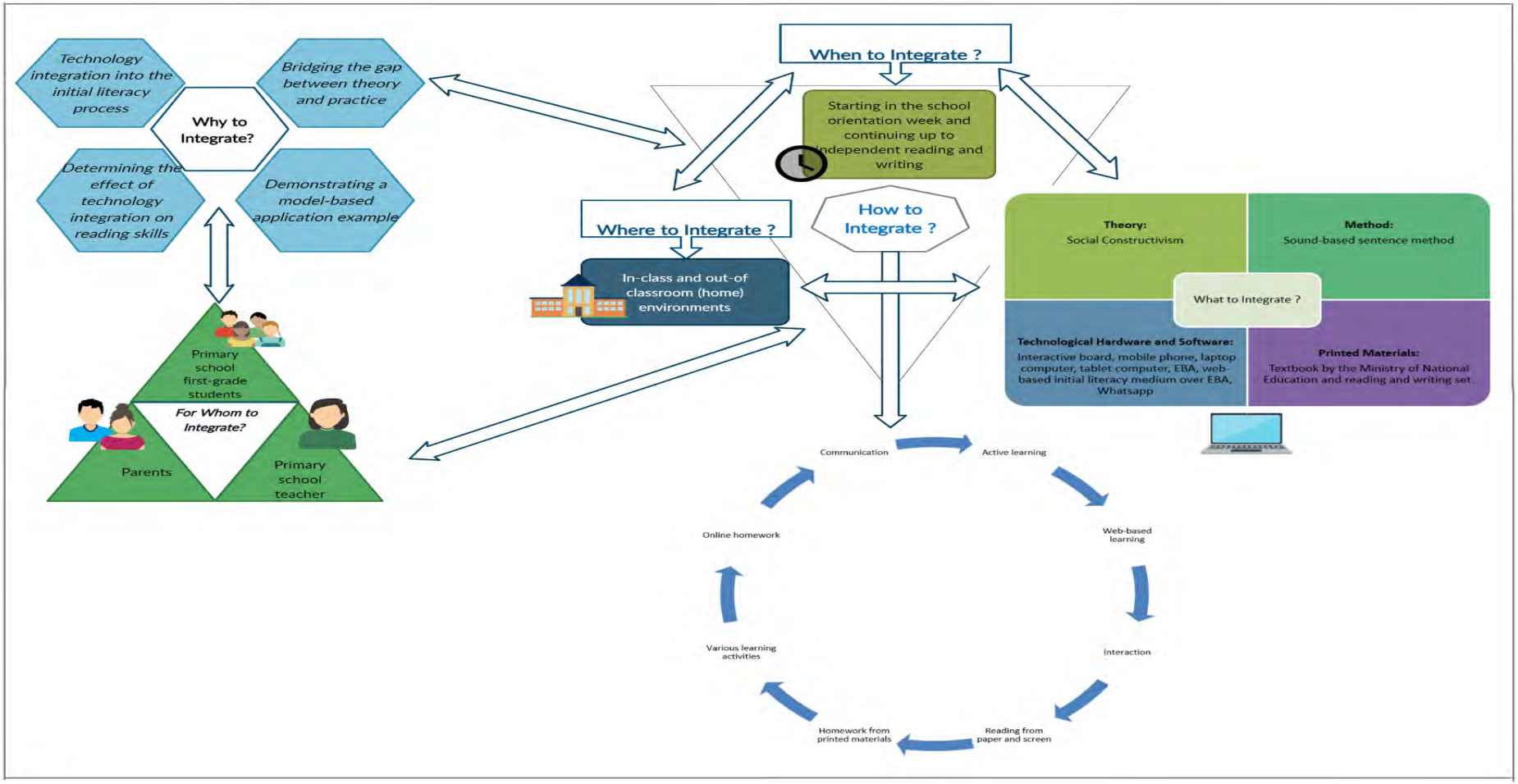


Figure 3. Sample application based on the 5W1H technology integration model

In the provision of the integration in the initial literacy teaching process, Vygotsky's social constructivist learning theory was used as the theory of integration, Sound Based Sentence Method recommended in the Turkish Curriculum of the Ministry of National Education, Education and Training Board was used as the method, interactive board (in the classroom), tablet computer (at home), mobile phone (at home) and laptop (at home) were used as the technological equipment and the Web-based initial literacy environment and Whatsapp messaging platform were used as the technological software. The sample application based on the 5W1H technology integration model was conducted in the classroom environment and in the out-of-class (home) environment through parental guidance. The application was started during the school orientation week and was completed when the children switched to independent reading. The visual summary of the model is given in Figure 3.

FINDINGS

In this section, the phonological awareness skills pre-test and post-test scores, transition times to reading, speed and levels of reading from paper and screen, errors in reading from paper and screen, and attitudes towards the reading of primary school freshmen in which a technology integration model-based application example was implemented in the first literacy teaching process findings and comments are included.

Findings related to Phonological Awareness Skills

In the current study, dependent samples t-test was conducted to determine whether there occurred a significant change in the phonological awareness skills (matching words starting with the same sound, noticing rhymed words, finding the initial sound of the given word, producing words starting with a stimulating sound, producing words starting with the same sound, omitting syllables or sounds, combining sounds) of primary school first-grade students who were subjected to a sample application based on the technology integration model in the initial literacy teaching process. In Table 3 below, the dependent samples t-test results showing the students' phonological awareness pretest and posttest scores are given.

Table 3. Results of the dependent samples t-test conducted to compare the pretest and posttest scores of the students subjected to the sample application based on the technology integration model

Matching Words Starting with the Same Sound	**N**	**Mean**	**Std.Dev.**	**df**	**t**	**p**
Pretest	30	3.23	1.52	29	-7.97	.00*
Posttest	30	5.53	.86			
Noticing Rhymed Words	**N**	**Mean**	**Std.Dev.**	**df**	**t**	**p**
Pretest	30	4.76	2.37	29	-7.75	.00*
Posttest	30	8.10	1.26			
Finding the Initial Sound of the Given Word	**N**	**Mean**	**Std.Dev.**	**df**	**t**	**p**
Pretest	30	7.00	3.50	29	-4.33	.00*
Posttest	30	9.36	1.35			
Producing Words Starting with a Stimulating Sound	**N**	**Mean**	**Std.Dev.**	**df**	**t**	**p**
Pretest	30	3.46	2.14	29	-5.36	.00*
Posttest	30	5.50	.93			
Producing Words Starting with the Same Sound	**N**	**Mean**	**Std.Dev.**	**df**	**t**	**p**
Pretest	30	1.90	1.49	29	-14.29	.00*
Posttest	30	5.50	.93			
Omitting Syllables or Sounds	**N**	**Mean**	**Std.Dev.**	**df**	**t**	**p**
Pretest	30	3.66	3.60	29	-7.07	.00*
Posttest	30	8.46	1.63			
Combining Sounds	**N**	**Mean**	**Std.Dev.**	**df**	**t**	**p**
Pretest	30	2.73	2.50	29	-8.42	.00*
Posttest	30	6.60	.72			
Phonological Awareness Skills Total	**N**	**Mean**	**Std.Dev.**	**df**	**t**	**p**
Pretest	30	26.76	12.25	29	-10.77	.00*
Posttest	30	48.06	5.40			

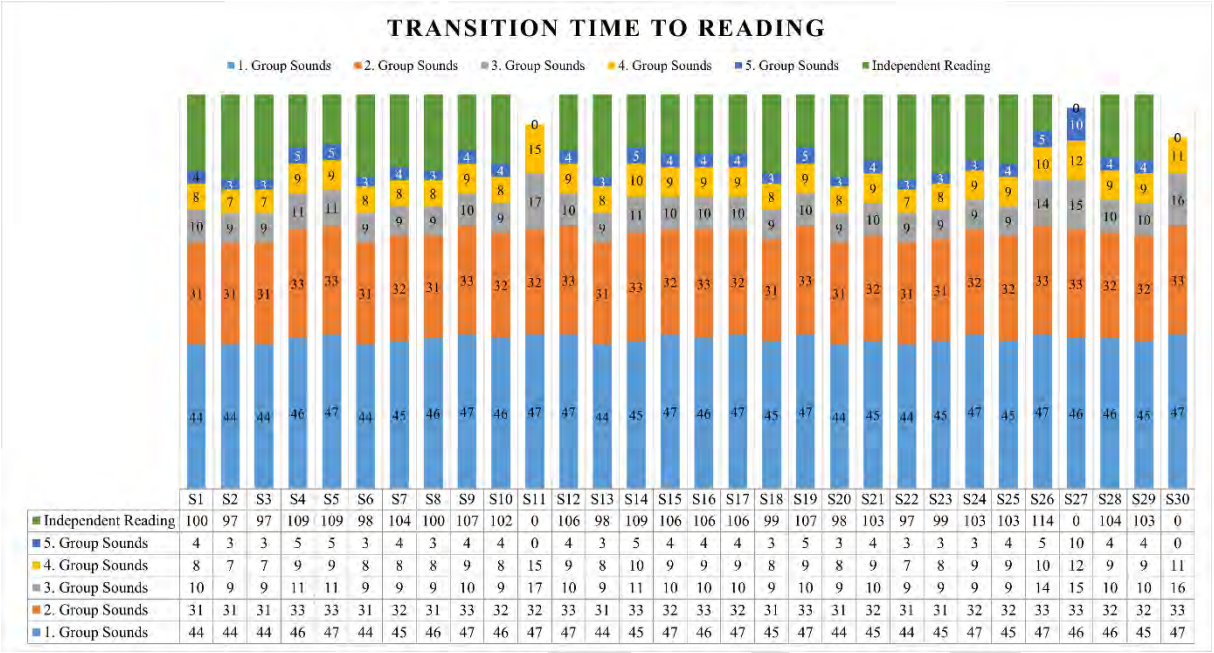
*p<.05

The results of the dependent samples t-test conducted to determine whether the primary school first-grade students' phonological awareness skills varied significantly as a result of their exposure to the sample application based on the technology integration model are given in Table 3. As a result of the analysis, it was found that there is a significant difference [$t_{(29)}$= -7.97, p<.05] between the pretest mean score ($Mean_{Pretest}$=3.23) and posttest mean score ($Mean_{Posttest}$=5.53) taken for the skill of matching words starting with the same sound and the effect size of this difference was found to be large (d=-1,46); that there is a significant difference [$t_{(29)}$=-7.75, p<.05] between the pretest mean score ($Mean_{Pretest}$=4.76) and the posttest mean score ($Mean_{Posttest}$=8.10) taken for the skill of noticing rhymed words and the effect size of this difference was found to be large (d=-1.41); that there is a significant difference [$t_{(29)}$=-4.33, p<.05] between the pretest mean score ($Mean_{Pretest}$=7.00) and the posttest mean score ($Mean_{Posttest}$=9.36) taken for the skill of finding the initial sound of the given word and the effect size of this difference was found to be medium (d=-0.62); that there is a significant difference [$t_{(29)}$=-5.36, p<.05] between the pretest mean score ($Mean_{Pretest}$=3.46) and the posttest mean score ($Mean_{Posttest}$=5.50) taken for the skill of producing words starting with a stimulating sound and the effect size of this difference was found to be large (d=-0.97); that there is a significant difference [$t_{(29)}$=-14.29, p<.05] between the pretest mean score ($Mean_{Pretest}$=1.90) and posttest mean score ($Mean_{Posttest}$=5.50) taken for the skill of producing words starting with the same sound and the effect size of this difference was found to be large (d=2.62); that there is a significant difference [$t_{(29)}$=-7.07, p<.05] between the pretest mean score ($Mean_{Pretest}$=3.66) and the posttest mean score ($Mean_{Posttest}$=8.46) taken for the skill of omitting syllables and sounds and the effect size of this difference was found to be large (d=1.29); that there is a significant difference [$t_{(29)}$=-8.42, p<.05] between the pretest mean score ($Mean_{Pretest}$=2.73) and posttest mean score ($Mean_{Posttest}$=6.60) taken for the skill of combining sounds and the effect size of this difference was found to be large (d=1.53). As a result of the dependent samples t-test, it was also found that there is a significant difference [$t_{(29)}$=-10.77, p<.05] between the total pretest mean score ($Mean_{Pretest}$=26.76) and the total posttest mean score ($Mean_{Posttest}$=48.06) and the effect size of this difference was found to be large (d=1.96). The contribution of the students' engagement in various activities such as listening to songs for each specific sound, watching animations, and constructing syllables and words through interactive activities during the sample application to this general large effect size is thought to be important. These findings show that the sample application conducted based on the technology integration model had a significant effect on the development of the primary school first-grade students' phonological awareness skills.

Findings related to Transition to Reading

In the current study, in order to determine the time of transition to reading of the primary school first-grade students subjected to the sample application based on the technology integration model, from the date of the first start of the initial literacy teaching process onward, the dates when each student started reading syllables, words, sentences and texts related to sounds in the 1st, 2nd, 3rd, 4th and 5th sound/letter groups [the sounds/letters in the Turkish alphabet in Turkey are taught by being classified into 5 groups on the basis of the principle of from the easiest to the most difficult: e, l, a, k, i, n in the first group; o, m, u, t, ü, y in the second group; ö, r, ı, d, s, b in the third group; z, ç, g, ş, c, p in the fourth group and h, v, ğ, f, j in the fifth group] in the Turkish curriculum implemented in Turkey and the dates when the students started reading independently after the completion of study of the sound/letter groups were added to the form of time of transition to reading. The added dates were then written as days and the primary school first-grade students' times of reading the syllables, words, sentences, and texts in the relevant sound groups and their transition to independent reading were determined. The number of days in which the primary school first-grade students read the syllables, words, sentences, and texts in the relevant sound group and switched to independent reading is shown in Figure 4.

IOJPE
ISSN: 1300 – 915X
www.iojpe.org
International Online Journal of Primary Education 2022, volume 11, issue 2



	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30
Independent Reading	100	97	97	109	109	98	104	100	107	102	0	106	98	109	106	106	106	99	107	98	103	97	99	103	103	114	0	104	103	0
5. Group Sounds	4	3	3	5	5	3	4	3	4	4	0	4	3	5	4	4	4	3	5	3	4	3	3	3	4	5	10	4	4	0
4. Group Sounds	8	7	7	9	9	8	8	8	9	8	15	9	8	10	9	9	9	8	9	8	9	7	8	9	9	10	12	9	9	11
3. Group Sounds	10	9	9	11	11	9	9	9	10	9	17	10	9	11	10	10	10	9	10	9	10	9	9	9	9	14	15	10	10	16
2. Group Sounds	31	31	31	33	33	31	32	31	33	32	32	33	31	33	32	33	32	31	33	31	32	31	31	32	32	33	33	32	32	33
1. Group Sounds	44	44	44	46	47	44	45	46	47	46	47	47	44	45	47	46	47	45	47	44	45	44	45	47	45	47	46	46	45	47

Figure 4. Times in which the primary school first-grade students read the syllables, words, sentences, and texts in the relevant sound group and switched to independent reading.

As can be seen in Figure 4, the primary school first-grade students started reading the syllables, words, sentences and texts related to the sounds in the 1st group within a time period ranging from 44 to 47 days; the syllables, words, sentences and texts related to the sounds in the 2nd group within a time period ranging from 31 to 33 days; the syllables, words, sentences, and texts related to the sounds in the 3rd group within a time period ranging from 9 to 17 days; the syllables, words, sentences and texts related to the sounds in the 4th group within a time period ranging from 7 to 15 days and the syllables, words, sentences and texts related to the sounds in the 5th group within a time period ranging from 3 to 5 days. Of the participating students, 27 started independent reading within a time period ranging from 97 to 114 days while the remaining three students (S11, S27, and S30) could not start independent reading. When these data are examined, it is seen that there is a decrease in the time period in which the students completed reading the syllables, words, sentences, and texts related to the other sound groups after completing reading the syllables, words, sentences, and texts related to the first sound group. This shows that the students became more and more practical in the context of combining the learned sounds and decoding the reading. It is thought that the shortening of the reading time, especially after the 1st and 2nd sound groups is due to the sample application based on the technology integration model. Thus, it can be argued that the necessary infrastructure for learning to read was formed in the students, and accordingly, the students could read the syllables, words, sentences and texts related to the other three sound groups in a shorter period. Through the sample application based on the technology integration model, the primary school first-grade students acquired the necessary skills in the 1st and 2nd sound/letter groups in terms of combining sounds and reading and practiced these skills in the other sound/letter groups and switched to independent reading.

Findings Related to Speed and Level of Reading from Paper and Screen

In the current study, to determine the reading speed and level of the primary school first-grade students subjected to the sample application based on the technology integration model in their initial literacy teaching process, the researcher had the students read the same text from paper and screen after they switched to independent reading (February 2021 / Winter term). While the students were reading the text, they were video-recorded by the researcher. Then, the video recordings were watched by the researcher and the students' reading speed was determined according to how long it took them to read the text and the number of words they read correctly in one minute, and their percentages of word

recognition and reading levels were determined according to the Error Analysis Inventory. The students' time to complete the reading of the text, reading speed, word recognition percentages, and levels are explained in Table 4.

Table 4. The primary school first-grade students' speed and level of reading from paper and screen

	Reading from Paper				Reading from Screen			
Student	**Time to Read the Text**	**Reading Speed**	**Word Recognition Percentage**	**Reading Level**	**Time to Read the Text**	**Reading Speed**	**Word Recognition Percentage**	**Reading Level**
S1	4.3	15	84	Worry	5.3	17	99	Free
S2	2.03	37	92	Teaching	2.12	43	99	Free
S3	1.15	63	96	Teaching	1.05	69	91	Teaching
S4	3.1	21	94	Teaching	3.24	24	96	Teaching
S5	4.54	14	92	Teaching	4	21	92	Teaching
S6	4.34	16	92	Teaching	4.22	21	97	Teaching
S7	2.43	22	71	Worry	4.06	20	92	Teaching
S8	5	6	83	Worry	4.12	16	85	Worry
S9	4.55	20	92	Teaching	2.76	22	95	Teaching
S10	2.1	35	94	Teaching	2.13	40	99	Free
S11	*Recognizes sounds and letters but cannot read independently.*							
S12	5.45	13	92	Teaching	4.42	20	95	Teaching
S13	2.15	30	82	Worry	2.14	33	88	Worry
S14	5.31	17	92	Teaching	4.23	19	89	Worry
S15	1.23	44	74	Worry	1.49	48	99	Free
S16	5.93	6	81	Worry	5.55	11	88	Worry
S17	1.47	48	100	Free	1.4	49	99	Free
S18	4.57	12	72	Worry	5.83	16	95	Teaching
S19	5.77	3	68	Worry	8.49	7	86	Worry
S20	1.41	38	85	Worry	2.06	42	99	Free
S21	6.44	12	83	Worry	5.24	13	91	Teaching
S22	2.4	31	77	Worry	2.03	32	82	Worry
S23	3.15	22	94	Teaching	3.2	30	97	Teaching
S24	1.43	39	92	Teaching	2.01	46	100	Free
S25	6.33	7	70	Worry	5.53	7	74	Worry
S26	5.88	6	76	Worry	9	7	90	Teaching
S27	*Recognizes sounds and letters but cannot read independently.*							
S28	9	9	92	Teaching	8.05	13	89	Worry
S29	4.76	17	95	Teaching	4.52	17	100	Free
S30	*Recognizes sounds and letters but cannot read independently.*							

When Table 4 is examined, it is seen that the primary school first-grade students' time of reading from paper ranges from 1.15 to 9 minutes while their time of reading from screen ranges from 1.05 to 9 minutes. Of the participating 30 students, S11, S27, and S30 were able to recognize the sounds and letters but could not combine and read them. The remaining 27 students' times of reading from paper and screen are as follows; 5 students read the whole text from the paper within a time period ranging from 1 to 2 minutes; 5 students in a time period ranging from 2.01 to 3 minutes; 2 students in a time

period ranging from 3.01 to 4 minutes; 7 students in a time period ranging from 4.01 to 5 minutes; 5 students in a time period ranging from 5.01 to 6 minutes; 2 students in a time period ranging from 6.01 to 7 minutes and 1 student in 9 minutes. On the other hand, 3 students read the whole text from the screen within a time period ranging from 1 to 2 minutes; 7 students within a time period ranging from 2.01 to 3 minutes; 3 students within a time period ranging from 3.01 to 4 minutes; 6 students within a time period ranging from 4.01 to 5 minutes; 5 students within a time period ranging from 5.01 to 6 minutes and 3 students within a time period ranging from 8.01 to 9 minutes. Accordingly, the means of the students' times of reading from paper and screen were calculated. The students' mean time of reading from paper was found to be Mean = 3.93 while that of reading from screen was found to be Mean = 4. When the means are examined, it is seen that the students completed reading from paper in less time than screen, with a difference of 7 seconds. Since the difference is very small, it can be said that the reading times from paper and screen are almost the same.

Reading speed was determined according to the correct number of words that the students read from paper and screen in 1 minute. As can be seen in Table 4, one student's reading speed from paper was found to be 63, 8 students' reading speeds from paper were found to be varying between 30 and 48, 12 students' reading speeds from paper were found to be varying between 12 and 22, 6 students' reading speeds from paper were found to be varying between 3 and 9. When the students' reading speeds from screen were examined, 1 student's reading speed from screen was found to be 69, 9 students' reading speeds from screen were found to be varying between 30 and 49, 14 students' reading speeds from screen were found to be varying between 11 and 24, 3 students' reading speeds from screen were found to be 7. Three students could not switch to independent reading. In Turkey, there are no standardized norms regarding the reading speed of students on a class and term basis. The existing research indicates that primary school first-grade students are expected to read between 0-10 words in the fall term, between 10-50 words in the winter term, and between 30-90 words in the spring term (Akyol, Yıldırım, Ateş, Çetinkaya & Rasinski, 2014). Thus, it can be argued that 21 of the participating primary school first-grade students' reading speeds from paper and 24 of the participating primary school first-grade students' reading speeds from screen comply with their grade level for the winter term.

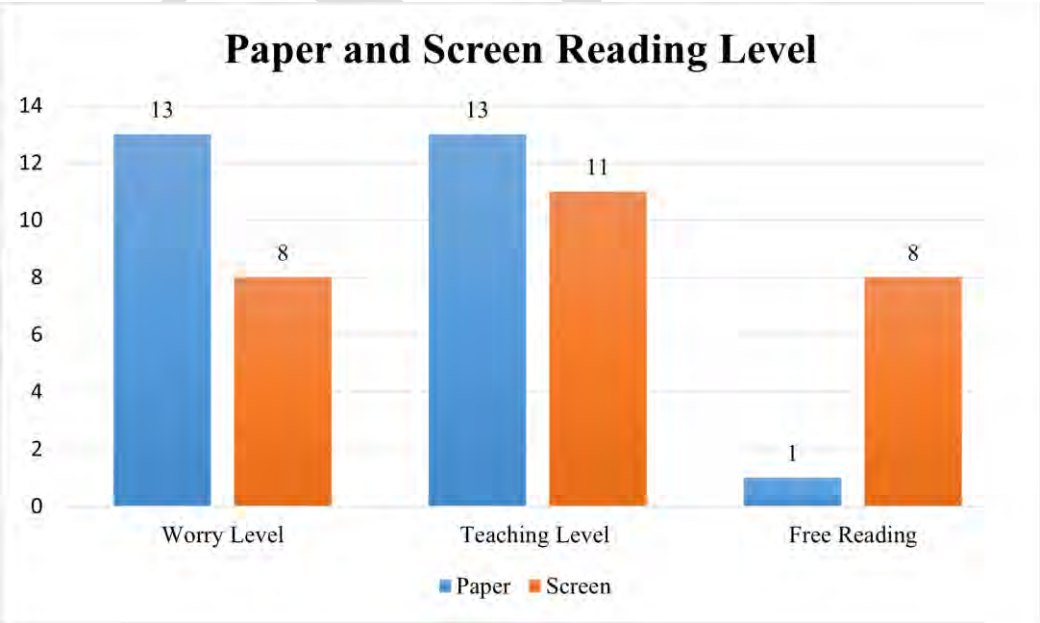


Figure 5. Levels of reading from paper and screen

In the current study, the percentages of word recognition from paper and screen and, accordingly, reading level of the primary school first-grade students were determined. Although there is no expectation in terms of reading level for the winter term for primary school first-grade students

(Akyol, Yıldırım, Ateş, Çetinkaya, & Rasinski, 2014), word recognition percentages and reading levels of the primary school first-grade students were determined as a result of the application in the current study. As can be seen in Table 4, 14 students' word recognition percentages from paper are 92 and higher, and 13 students' word recognition percentages are 85 and lower. Thus, one student's reading level from paper is at the free reading level, 13 students' reading levels from paper are at the teaching level and 13 students' reading levels from paper are at the worry level. When the word recognition percentages from screen in Table 4 are examined, it is seen that 19 students' word recognition percentages from screen are 90 and higher, and 8 students' word recognition percentages from screen are 89 and lower. Thus, it can be said that 8 students' reading levels from screen are at the free reading level, 11 students' reading levels from screen are at the teaching level and 8 students' reading levels from screen are at the worry level. The participating students' levels of reading from paper and screen are shown in Figure 5.

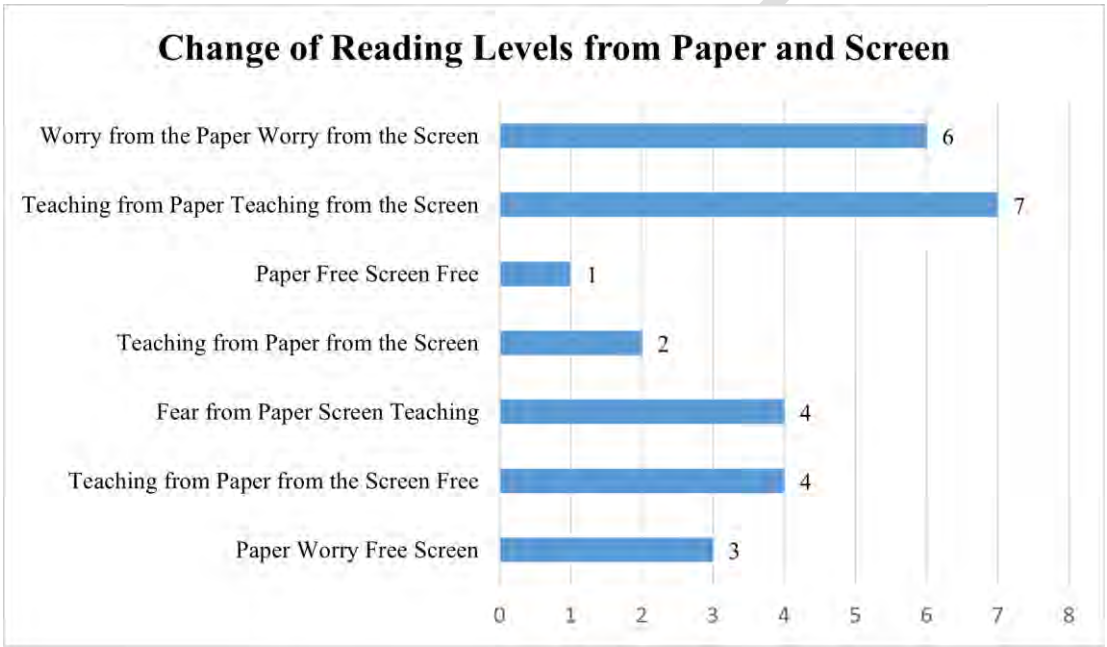


Figure 6. Change of reading levels from paper and screen

As can be seen in Figure 6, the participating primary school first-grade students' levels of reading from paper and screen varied. While 3 students are at the worry level in reading from paper, they are at the free level in reading from screen; while 4 students are at the teaching level in reading from paper, they are at the teaching level in reading from screen; while 4 students are at the worry level in reading from paper, they are at the teaching level in reading from screen; while 2 students are the teaching level in reading from paper, they are at the worry level in reading from screen; 1 student is at the free level in reading from both paper and screen; 7 students are at the teaching level in reading from both paper and screen and 6 students are at the worry level in reading from both paper and screen. These results show that while 13 students' levels of reading from paper and screen vary, 14 students' levels of reading from paper and screen are the same. When the reading levels of the students whose levels of reading from paper and screen vary are examined, it is seen that 11 students' levels of reading from screen improved more than their levels of reading from paper. On the other hand, 2 students' levels of reading from paper improved more than their levels of reading from screen. These results show that the levels of reading from screen of the primary school first-grade students subjected to the sample application based on the technology integration model are better than their levels of reading from paper in general. However, 2 students' levels of reading from paper were found to be improved more than their levels of reading from screen, which might be related to individual differences or different variables affecting their levels of reading from paper and screen.

Findings related to Errors in Reading from Paper and Screen

In the current study, to determine the primary school first-grade students' errors in reading from paper and screen, the students read the texts determined by the researcher in advance after the students started to read independently (February, 2021/Winter term). The obtained results are shown in Figure 7.

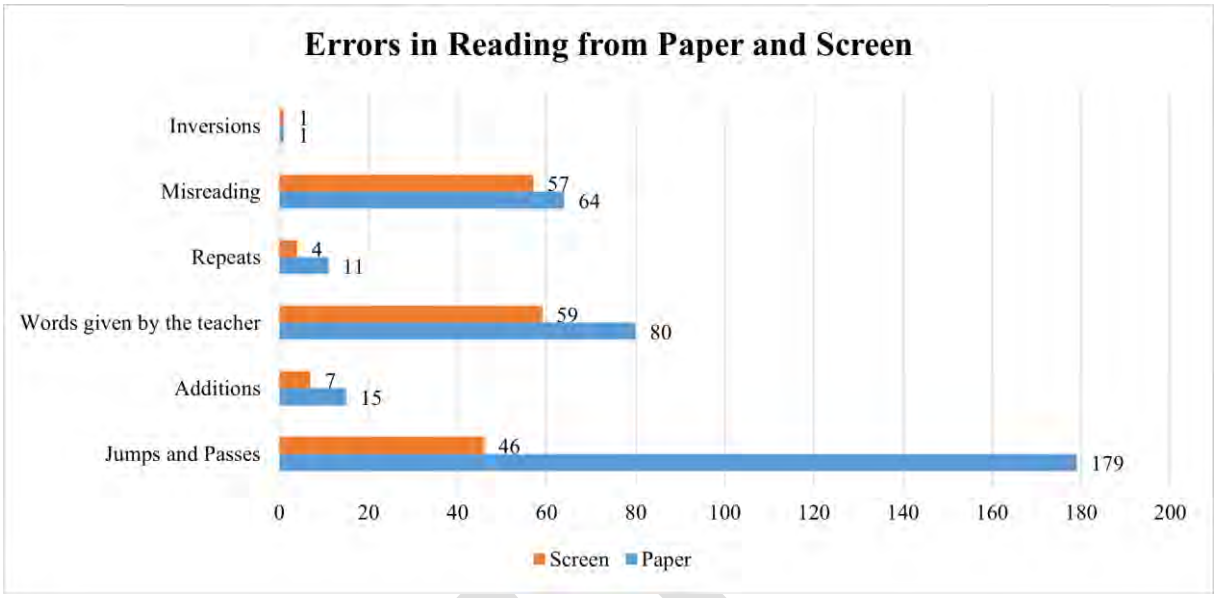


Figure 7. Errors in reading from paper and screen

As can be seen in Figure 7, the primary school first-grade students subjected to the sample application based on the technology integration model committed 2 errors of inversion, one in reading from paper and one in reading from screen, 64 errors of misreading in reading from paper and 57 errors of misreading in reading from screen, 11 errors of repeats in reading from paper and 4 errors of misreading in reading from screen, 80 errors of words given by the teacher in reading from paper and 59 errors of words given by the teacher in reading from screen, 15 errors of additions in reading from paper and 7 errors of additions in reading from screen and 179 errors of jumps and passes in reading from paper and 46 errors of jumps and passes in reading from screen. Except for the error of inversion, the primary school first-grade students made more errors in reading from paper than in reading from screen. Moreover, according to the types of errors, the most frequently committed error by the students is jumps and passes, followed by words given by the teacher and misreading. These findings show that the primary school first-grade students subjected to the sample application based on the technology integration model read more correctly from screen than from paper. Although the texts read throughout the study from paper and screen were the same, the reason why the students committed more errors in reading from paper than from screen might be because they interact more with technological tools in their daily lives, and thus, reading activities from screen can be more interesting for students and they can feel more motivated to read from screen.

Findings related to Attitudes towards Reading

In the current study, to determine the attitudes of the primary school first-grade students subjected to the sample application based on the technology integration model towards reading, the researcher administered a reading attitude scale to the students after they started to read independently (February, 2021/Winter term). The results of the reading attitude scale administered to the primary school first-grade students are shown in Table 5.

Table 5. Descriptive statistics for the attitudes of the primary school first-grade students toward reading

Dimension	N	The Lowest Score	The Highest Score	Mean	Std.Dev.
Attitude towards Reading for Enjoyment	30	.00	40.00	32.83	11.41
Attitude towards Reading for Academic Purposes	30	.00	39.00	32.93	11.34
Total Reading Attitude	30	.00	79.00	65.76	22.66

Table 5 shows the results of the descriptive statistics found for the reading attitude sub-dimensions and total reading attitude of the primary school first-grade students subjected to sample application based on the technology integration model. Thus, the mean score taken for the sub-dimension of attitude towards reading for enjoyment was calculated to be 32.83, the mean score for the sub-dimension of attitude towards reading for academic purposes was calculated to be 32.93 and the mean total attitude score was calculated to be 65.76. The mean attitude scores taken for the sub-dimensions and for the whole scale were found to be closer to the highest score. In light of these results, it can be said the applications supported with digital activities motivated the primary school first-grade students as such activities are a natural part of their daily lives and thus, their attitudes towards reading were found to be quite high.

DISCUSSION and CONCLUSION

In this section, the results derived from the findings and their discussion are presented. As a result of the administration of the sample application based on the technology integration model to the primary school first-grade students, the scores taken by the students for the phonological awareness skills of matching words starting with the same sound, noticing rhymed words, finding the initial sound of the given word, producing words starting with a stimulating sound, producing words starting with the same sound, omitting syllables or sounds, combining sounds and their total phonological awareness score were found to have significantly increased in the posttest compared to their pretest scores. Some studies in the relevant literature emphasize that computer-assisted education, educational software and multimedia-supported content improve students' phonological awareness and reading skills (Bishop & Santoro, 2006; Demirmenci & Ertem, 2014; Fasting & Lyster, 2005; Littleton, Wood & Chera, 2006; Macaruso, Hook & McCabe, 2006; Macaruso & Walker, 2008). In addition, it is argued that electronic texts and supporting technologies embedded in these electronic texts improve phonological awareness skills (Cheung & Slavin, 2012; Larson, 2009; McKenna, Reinking, Labbo, & Kieffer, 1999). The results of the research reported in the relevant literature concur with the results obtained in the current study concerning phonological awareness skills. It can be said that the development of phonological awareness skills of the primary school first-grade students, who were subjected to the sample application based on the technology integration model, positively affected their time of transition to independent reading and reading speed and level specified in the second and third problems of the current study. Rubba (2004) suggests phonological awareness as a prerequisite for initial literacy teaching. There are studies emphasizing the importance of phonological awareness for learning to read and being a successful reader (Nunes, Bryant, & Barros, 2012; Pennington & Lefly, 2001; Pullen & Justice, 2003; Scarborough, 1990). Mann (1987) and Stanovich, Cunningham, & Cramer (1984) confirmed phonological awareness as an important predictor of reading success.

It was determined that primary school 1st-grade students, who were involved in a technology integration model-based application in the first literacy teaching process, had a decrease in the time they started to read from the first group sounds/letters to the last group sounds/letters. This shows that the students understood the logic of reading and became automatic. This is thought to be due to the

repetitions made based on digital technologies because, employing digital technologies, the students were able to see more visual and auditory elements and to do more repetitions and exercises. In this way, in the context of combining sounds and reading, the necessary infrastructure was formed in the students and they became more practical, especially after the completion of 1st and 2nd group sounds/letters. When the relevant literature is reviewed, it is seen the use of digital technologies in the teaching process provides students with the opportunity to repeat more than once, gives instant feedback (Lovell & Phillips, 2009; Musti-Rao, Lo & Plati, 2015), reduces their cognitive load (Mayer & Moreno, 2010), individualizes their learning (Englert, Manalo, & Zhao, 2004), and allows them to learn at their own pace (Littleton, Wood & Chera, 2006; Lovell & Phillips, 2009; Sorrell, Bell, & McCallum, 2007). The advantages of digital technologies such as providing students with the opportunity to repeat, allowing them to learn at their own pace, giving feedback and fostering learning and reading in a shorter time and providing the opportunity to practice will enable them to recognize words in a shorter time, thus increasing their speed of reading. The advantages of digital technologies and the inferences made based on the research results in the relevant literature can explain the finding of the current study showing a decrease in the time spent by primary school first-grade students on correctly learning the sounds/letters in the last sound groups compared to the first sound groups. It has been revealed by the results obtained in the current study that digital technologies have an effect on the transition time of primary school freshmen students to reading. However, digital technologies are not the only variable that is effective in the time of transition to reading. It should not be forgotten that different variables can also be effective. Yılmaz & Dikici Sığırtmaç (2008) stated that whether children have pre-school education, their parents' education status, and their families' monthly income affect their time of transition to reading. It was determined that the children who received pre-school education, whose parents have a high education level, and whose families have a high monthly income start to read in a shorter time.

The primary school first-grade students subjected to the sample application based on the technology integration model read the text from paper within a time period ranging from 1.15 to 9 minutes while they read the text from screen within a time period ranging from 1.05 to 9 minutes. The students' mean time of reading from paper was found to be 3.93 minutes while that of reading from screen was found to be 4 minutes. When the students' reading speeds from paper and screen were examined, their speeds of reading from paper were found to be varying between 3 and 63 while their speeds of reading from screen were found to be varying between 7 and 69. In Turkey, there are no standardized norms regarding the reading speed of students on a class and term basis. The existing research indicates that primary school first-grade students are expected to read between 0-10 words in the fall term, between 10-50 words in the winter term, and between 30-90 words in the spring term (Akyol, Yıldırım, Ateş, Çetinkaya, & Rasinski, 2014). Thus, it can be argued that 21 of the participating primary school first-grade students' reading speeds from paper and 24 of the participating primary school first-grade students' reading speeds from screen comply with their grade level for the winter term. The participating primary school first-grade students' mean speed of reading from paper in the winter term is 22.33 while their mean speed of reading from screen is 26. The mean reading speeds of the primary school first-grade students show that the students read from paper and screen at a speed expected in this grade level. While 13 students' levels of reading from paper and screen were found to be different, 14 students' levels of reading from paper and screen were found to be the same. When the reading levels of the students whose levels of reading from paper and screen varied were examined, it was seen that 11 students' levels of reading from screen improved more than their levels of reading from paper. On the other hand, 2 students' levels of reading from paper improved more than their levels of reading from screen. In light of these results, it can be said that technology-supported applications are effective on primary school freshmen students' reading speed and level from paper and screen. In general, the higher means obtained for reading from screen compared to reading from paper are thought to be since the applications are based on digital technologies and the students are active in the process. The only exception in these results is that the reading level of 2 students is more advanced in reading from paper than in reading from screen, which might be related to individual differences or different variables affecting their levels of reading from paper and screen.

When the relevant national and international literature is reviewed, it is seen that there are many studies on the effects of technology-supported applications on students' reading skills, speed, and success (Arens, Gove, & Abate, 2018; Cheung & Slavin, 2012; Değirmenci & Ertem, 2014; Gürol & Yıldız, 2015; Hilton-Prillhart, Hopkins, Skinner, & McCane-Bowling, 2011; Jamshidifarsani, Garbaya, Lim, Blazevic, & Ritchie, 2019; Kaya, 2018; Knezek & Christensen, 2007; Macaruso & Walker, 2008; Macaruso, Hook, & McCabe, 2006; Orhan Karsak, 2014b; Sorrell, Bell, & McCallum, 2007; Soydaş & Ertem, 2019; Şahin & Çakır, 2018; Şentürk Leylek, 2018; Yıldız, 2010). These results reported in the literature also support the positive effect of the sample application based on the technology integration model on the students' reading speed and level. This may indicate that technology-supported applications are effective on students' reading speed and level. However, in the related literature, there is a study reporting contrary findings. Çiftçi (2019) concluded that digital stories do not make a significant difference in students' reading comprehension, reading speed, and prosody. Thus, it can be said that variables such as characteristics of the application, environment, time, and practitioner may also predict the effect of technology-supported applications on reading skills. The sample application based on the technology integration model conducted in the current study improved the speed and level of reading from screen as well as from paper. The students' speed and level of reading from screen are better than their reading from paper and screen. This might mean that the education given based on digital technologies improved reading from screen from the first group of sounds/letters. In this connection, Ak (2019) stated that as a result of screen and paper reading practices and doing screen reading exercises continuously and regularly, the students' comprehension of what they read from paper improved and reading from screen had a positive effect on the reading speed of the students. For this reason, as in the sample application based on the technology integration model, students should be taught based on digital technologies from the first literacy teaching onwards and they should have screen reading exercises. The practices conducted in the current study had a positive effect on the primary school first-grade students' speed and level of reading from paper and screen. Cheung and Slavin (2012) state that one of the ways to increase students' reading success is through technology.

The primary school first-grade students subjected to the sample application based on the technology integration model made errors in reading from paper and screen. It was determined that the primary school first-grade students made more reading errors in reading from paper than from screen in all types of reading errors, except for one type of reading error. The most frequent type of error committed by the students in reading was found to be jumps and passes, followed by the words given by the teacher and misreading. In light of these results, it can be said that the sample application based on the technology integration model conducted in the initial literacy teaching process enabled students to make fewer reading errors in reading from screen than in reading from paper. Although the texts read throughout the study from paper and screen were the same, the reason why the students committed more errors in reading from paper than from screen might be because they interact more with technological tools in their daily lives, and thus, reading activities from screen can be more interesting for students and they can feel more motivated to read from screen. There are many studies in the related literature reporting that technology-supported applications reduce students' reading errors and increase their rates of correct reading (Değirmenci & Ertem, 2014; Kaman, 2018; Knezek & Christensen, 2007; Soydaş & Ertem, 2019; Yıldız, 2010). Some researchers argue that information technology and paper reading skills are necessary for online and screen reading (Leu, Kinzer, Coiro, & Cammack, 2004; Organisation for Economic Co-operation and Development, 2010). The finding obtained in the current study showing that the primary school first-grade students made fewer reading errors in reading from screen compared to reading from paper may indicate that the students have already acquired the required information technology and paper reading skills pointed out in the literature. In this regard, Larson (2010) conducted a study on primary school first-grade students and found that the students had more control over texts in e-books presented to them on screen than the texts they read on paper. This stronger control over the texts may result in fewer errors to be committed by students. The fact that the errors made by the primary school first-grade students subjected to the sample application based on the technology integration model while reading from

paper and screen are as expected from first-graders and that they made fewer errors in reading from screen may indicate that the necessary infrastructure for the development of fluent reading was formed in the students. The participating students' making fewer errors in reading from screen shows that their screen reading skills started to develop from the initial literacy teaching process onwards. This result shows the importance of the current study considering the fact that many reading activities are performed on screen in the digital age we live in.

The mean score taken by the primary school first-grade students subjected to the sample application based on the technology integration model for the sub-dimension of attitude towards reading for enjoyment was calculated to be 32.83, the mean score for the sub-dimension of attitude towards reading for academic purposes was calculated to be 32.93 and the mean total attitude score was calculated to be 65.76. The mean attitude scores taken for the sub-dimensions (the highest score for reading for enjoyment = 40 / the highest score for academic purposes = 39) and for whole the scale (the highest score = 79) were found to be closer to the highest score. Based on these results, it can be said that the use of digital technologies within the context of the current study, the active participation of the students in interactive activities in the classroom and online lessons and their completing these activities, the sending of online e-contents as homework together with printed materials outside the class and their involvement in reading activities from paper and screen might have made positive contributions to the students' attitudes towards reading. With these results, the effect of applications based on digital technologies on the attitude towards reading has been revealed. When the literature on the effect of technology-supported applications on the attitude towards reading is examined, it is seen that besides the studies reporting that technology-supported applications positively affect the attitude towards reading (Ak, 2019; Çetinkaya Özdemir, 2019; Hargrove, 2019; Kesik & Baş, 2021; Şahin & Çakır, 2018), there are also some studies showing that they have no effect (Kaman, 2018; Şentürk Leylek, 2018). While the majority of these results in the relevant literature support the results of the current study showing the positive effects of digital applications on primary school first-grade students' attitudes towards reading, very few studies show the opposite. Different variables may have led to the emergence of contradictory findings. However, in general, it is seen that technology-supported applications have positive effects on students' motivation and attitudes towards reading. Yunus, Nordin, Salehi, Sun, & Embi (2013) state that information technologies are beneficial in attracting students' attention, while Lee & Wu (2012) state that students' attitudes towards computers and literacy skills improve if they have information technology equipment at home. It is important for children to develop positive attitudes towards reading from the freshmen in terms of gaining reading habits and increasing their academic success. The fact that technology-supported applications mostly develop positive attitudes in the initial literacy teaching process reveals the importance of such studies.

Recommendations for Researchers

- Future research should be conducted to determine the effect of technology-supported teaching practices on the development of each sub-skill of phonological awareness skills.
- Experimental research can be designed to determine the effect of technology-supported applications on different grade levels and reading skills.
- The reasons why students' screen reading speed and level are better than their paper reading speed and level should be investigated.
- The effect of technology-supported applications on paper and screen reading speed and level at different grade levels should be investigated.
- The causes of reading errors that occur in primary school students' reading from screen and paper should be investigated.
- It should be investigated which elements of technology-assisted teaching applications are influential on primary school children's reading attitudes and motivation.

Recommendations for Practitioners

- Classroom teachers should benefit from the technology integration model-based application example in the first literacy teaching process.

- It is recommended to be patient in the process of technology-supported primary literacy teaching, to try to eliminate errors and deficiencies by observing, and to make motivating explanations.
- In the teaching of reading, reading from the screen should be done together with reading on paper.
- Students should be active in creating syllables, words, and sentences. Students should come to the interactive whiteboard and do the exercises themselves with the interactive e-contents.
- Which technological hardware and software will be used at which stage of the first literacy teaching should be planned in advance. Lesson designs should be created accordingly.
- Different platforms and messaging tools should be used actively in the first literacy teaching process.
- During the school adjustment week, students and parents should be informed about the use of educational software, platforms and tools to be used in the first literacy teaching process.
- In the first literacy teaching, online digital content should be sent along with homework from printed materials.

Limitations

- The research is limited to 30 freshmen primary school students studying in a state primary school in the Haliliye district of Şanlıurfa province in the 2020-2021 academic year.
- In terms of duration, the research is limited to 8 weeks in a face-to-face classroom environment in one-half term of the 2020-2021 academic year, and 13 weeks with online courses due to the Covid-19 outbreak.
- The research is limited to the teaching of 29 sounds/letters in the Turkish alphabet during the primary school freshmen Turkish lesson, the first reading and writing teaching process, and the 3-week reading activities when the children switch to independent literacy.
- The research is limited to one group post-test and one group pre-test-post-test weak experimental design.

Code availability

All analyses were performed with SPSS 22.0. No custom code was used.

Ethics and Conflicts of Interest Approval

This research is derived from the first author's doctoral thesis under the supervision of the second author. The study has undergone appropriate ethics protocol. The author(s) acted in accordance with the ethical rules in all matters such as data collection in the research, and that there is no conflict of interest between the authors. This research was ethically approved by the Hacettepe University Ethics Commission's letter dated 07 April 2020 and numbered 35853172-300. Informed consent was sought from the participants. No funding was received for the conduct of this study.

REFERENCES

Açıkalın, V. (2018). İlkokuma yazma eğitimi aşamasında etkileşimli tahta kullanımı [Use of interactive whiteboard in the initial literacy teaching]. *International Leadership Education Journal (ILEJ), 3*(3), 1-10.

Ak, E. (2019). *Ekrandan okumanın ilkokul öğrencilerinin okuma becerilerine ve okumaya yönelik tutumlarına etkisi* [The effect of screen reading on primary school students' reading skills and attitudes towards reading] (Unpublished master's thesis). Zonguldak Bülent Ecevit University, Zonguldak.

Akyol, H. (2020). *Programa uygun Türkçe öğretim yöntemleri* [Turkish teaching methods compatible with the curriculum (10th edition)]. Ankara: Pegem Akademy.

Akyol, H., Yıldırım, K., Ateş, S., Çetinkaya, Ç., & Rasinski, T. V. (2014). *Okumayı değerlendirme* [Evaluation of reading]. Ankara: Pegem A Publishing.

Arens, K., Gove, M. K., & Abate, R. (2018). Oral reading fluency with iPods. *Reading Improvement, 55*(2), 54–62.

Bishop, M. J., & Santoro, L. E. (2006). Evaluating beginning reading software for at-risk learners. *Psychology in the Schools, 43*(1), 57–70.

Chambers, B., Slavin, R. E., Madden, N. A., Abrami, P. C., Tucker, B. J., Cheung, A., & Gifford, R. (2008). Technology infusion in success for all: Reading outcomes for first graders. *The Elementary School Journal, 109*(1), 1-15.

Chauhan, S. (2017). A meta-analysis of the impact of technology on learning effectiveness of elementary students. *Computers & Education, 105*, 14-30.

Cheung, A. C. K., & Slavin, R. (2012). The effectiveness of educational technology applications for enhancing reading achievement in K-12 classrooms: A meta-analysis. Best Evidence Encyclopaedia. www.bestevidence.org

Christensen, L. B., Burke Johnson, R., & Turner, L. A. (2015). *Araştırma yöntemleri desen ve analiz* [Research methods design and analysis] (A. Aypay, translator editor). Ankara: Anı Publishing.

Connor, C. M., Day, S. L., Zargar, E., Wood, T. S., Taylor, K. S., Jones, M. R., & Hwang, J. K. (2019). Building word knowledge, learning strategies, and metacognition with the word-knowledge e-book. *Computers & Education, 128*, 284–311.

Çetinkaya Özdemir, E. (2019). *Artırılmış gerçeklik temelli okuma çalışmalarının bazı okuma değişkenleri ve derse katılım üzerindeki etkisi* [The effect of augmented reality-based reading activities on some reading variables and class participation] ((Unpublished Doctoral Dissertation). Gazi University Institute of Educational Sciences, Ankara.

Çiftçi, M. (2019). *Dijital hikâyelerin ilkokul ikinci sınıf öğrencilerinin okuma becerileri üzerindeki etkisi* [The effect of digital stories on the reading skills of primary school first-graders] (Unpublished master's thesis). University Institute of Social Sciences, Aksaray.

Değirmenci, H., & Ertem, İ. S. (2014). The impact of the educational software on first grade students' reading skills: Morpa Kampüs Application. *International Journal of Business, Humanities and Technology, 4*(4), 187-192.

Dewey, J. (2013). *Deneyim ve eğitim* [Experience and education]. Ankara: ODTÜ Publishing.

Duran, E., & Ertuğrul, B. (2012). İlköğretim sınıf öğretmenlerinin elektronik ders kitaplarına yönelik görüşleri [Opinions of primary school teachers about electronic textbooks]. *Turkish Educational Sciences Journal, 10* (2), 347-365.

Englert, C. S., Manalo, M., & Zhao, Y. (2004). I can do it better on the computer: The effects of technology-enabled scaffolding on young writers' composition. *Journal of Special Education Technology, 19*(1), 5–22.

Erdoğan, Ö. (2012). İlköğretim birinci sınıf öğrencilerinin fonolojik farkındalık becerileri ile okuma becerileri arasındaki ilişki [The relationship between primary school first grade students' phonological awareness skills and reading skills]. *Education and Science, 37*(166), 41-51.

Ertem, İ. S. (2014). Okuma yazma öğretiminde teknolojinin rolü: gelişmeler, yaklaşımlar, sorunlar ve yeni okuryazarlık [The role of technology in teaching literacy: developments, approaches, problems and new literacy]. İ. S. Ertem (Ed.), *Okuma Yazma Eğitimi ve Teknoloji* [in Literacy Education and Technology] (pp. 1-16). Ankara: Nobel Academic Publishing.

Ertem, İ. S. (2016). Oyun temelli dijital ortamlar ve Türkçe öğretiminde kullanımına ilişkin sınıf öğretmenlerinin görüşleri [Primary school teachers' views on game-based digital environments and their use in Turkish teaching]. *Mediterranean Journal of Educational Research, 20*, 1-10.

Fasting, R. B., & Lyster, S. H. (2005). The effects of computer technology in assisting the development of literacy in young struggling readers and spellers. *European Journal of Special Needs Education, 20*(1), 21–40.

Gökkuş, İ., & Akyol, H. (2020). Ses bilgisi farkındalık programının birinci sınıf öğrencilerinin sesbilgisel farkındalık becerilerinin gelişimine etkisi [The effect of phonological awareness program on the development of phonological awareness skills of first-grade students. *Cumhuriyet International Journal of Education, 9*(1), 308- 331.

Güneş, F. (2013). Okuma yazma öğrenme yaşı [The age of learning to read and write]. *Theory and Practice in Education, 9*(4), 280-298.

Güneş, F., Uysal, H., & Taç, İ. (2016). İlkokuma yazma öğretimi süreci: öğretmenim bana okuma yazmayı öğretir misin? [Initial literacy teaching process: teacher, can you teach me to read and write?]. *Journal of Educational Theory and Practice Research, 2* (2), 23-33.

Gürol, A., & Yıldız, E. (2015). İlk okuma yazma öğretiminde bilgisayar destekli eğitimin ilkokul birinci sınıf öğrencilerinin ilk okuma yazma becerilerine etkisi [The effect of computer-assisted teaching in initial literacy teaching on primary literacy skills of primary school first-grade students]. *International Journal of Field Education, 1*(1), 1-18.

Hargrove, C. M. (2019). *Integrating technology into the literacy curriculum within a first grade classroom* (PhD Thesis). Rowan University Department of Language, Literacy, and Sociocultural Education College of Education, New Jersey.

Haşlaman, T., Mumcu, F. K., & Usluel, Y. K. (2008). "Integration of ICT into the teaching-learning process: toward a unified model." Paper presented at World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED-MEDIA), Vienna, June 30-July 4, Austria.

Hilton-Prillhart, A. N., Hopkins, M. B., Skinner, C. H., & McCane-Bowling, S. J. (2011). Enhancing sight-word reading in second-grade students using a computer-based sightword reading system. *Journal of Evidence-Based Practices for Schools, 12*(2), 205–218.

Jamshidifarsani, H., Garbaya, S., Lim, T., Blazevic, P., & Ritchie, J.M. (2019). Technology-based reading intervention programs for elementary grades: An analytical review. *Computers & Education, 128*(2019), 427-451.

Johnson, L., Adams, S., & Cummins, M. (2012). *NMC horizon report: 2012 K-12 edition*. Austin: The New Media Consortium.

Kaman, Ş. (2018). *Dijital ve geleneksel metin temelli okuma çalışmalarının okuduğunu anlama, okuma hataları ve tutumları açısından karşılaştırılması* [Comparison of digital and traditional text-based reading activities in terms of reading comprehension, reading errors and attitudes] (Unpublished Doctoral Dissertation). Gazi University Institute of Educational Sciences, Ankara.

Karaman, G. (2013). *Erken okuryazarlık becerilerini değerlendirme aracının geliştirilmesi, geçerlik ve güvenirlik çalışması* [Development of early literacy skills assessment tool, validity and reliability study] (Unpublished Doctotal Dissertation). Gazi University Institute of Educational Sciences, Ankara.

Kartal, H., Baltacı Göktalay, Ş., & Sungurtekin, Ş. (2017). Okuma yazma öğretimine yönelik eğitsel yazılımların çok boyutlu değerlendirilmesi [Multidimensional evaluation of educational software for literacy teaching]. *Abant İzzet Baysal University Education Faculty Journal, 17*(4), 1938-1956.

Kaya, M. F. (2018). *4. Sınıf öğrencilerinin temel dil becerilerinin geliştirilmesine yönelik tersyüz sınıf modelinin uygulanması* [Application of the flipped classroom model for the development of basic language skills of 4th grade students] (Unpublished Doctoral Dissertation). Eskişehir Osmangazi University Institute of Educational Sciences, Eskişehir.

Kesik, C., & Baş, Ö. (2021). Sınıf öğretmenlerinin perspektifinden EBA ve eğitim portalları ile ilk okuma ve yazma öğretimi [Initial literacy teaching with EBA and education portals from the perspective of classroom teachers]. *Theory and Practice in Educational Technology, 11*(1), 93-115.

Kesik, C. (2021). *5N1K teknoloji modelinin ilkokul 1. sınıfta okuma becerisine ilişkin bazı değişkenlere etkisi* [The effect of the 5W1H technology model on some variables related to reading skills in the first grade of primary school] (Unpublished Doctoral Dissertation). Hacettepe University Institute of Educational Sciences, Ankara.

Kim, Y. S., Wagner, R. K., & Lopez, D. (2012). Developmental relations between reading fluency and reading comprehension: A longitudinal study from grade 1 to grade 2. *Journal of Experimental Child Psychology, 113*(1), 93-111.

Knezek, G., & Christensen, R. (2007). Effect of technology-based programs on first and second grade reading achievement. *Computers in the Schools, 24*(3/4), 23-41.

Kocaarslan, M. (2016). "Garfield" görselli 1-6. sınıflar için okumaya yönelik tutum ölçeğinin Türkçe uyarlama çalışması [Turkish adaptation study of the scale of attitude with "Garfield" visual towards reading for grades 1-6]. *Elementary Education Online, 15*(4), 1217-1233.

Krcmar, M., & Cingel, D. P. (2014). Parent–child joint reading in traditional and electronic formats. *Media Psychology, 17*(3), 262-281.

Larson, L. C. (2009). E-reading and e-responding: New tools for the next generation of readers. *Journal of Adolescent & Adult Literacy, 53*(3), 255-258.

Larson, L. C. (2010). Digital Readers: The next chapter in e-book reading and response. *The Reading Teacher, 64*(1), 15-22.

Lee, Y. H., & Wu, J. Y. (2012). The effect of individual differences in the inner and outer states of ICT on engagement in online reading activities and PISA 2009 reading literacy: exploring the relationship between the old and new reading literacy. *Learning and Individual Differences, 22*(3), 336-342.

Leu, D. J., Kinzer, C. K., Coiro, J. L., & Cammack, D. W. (2004). Toward a theory of new literacies emerging from the internet and other information and communication technologies. R. B. Ruddell and N. Unrau (Eds.), *Theoretical models and processes of reading* içinde (p. 1570-1613). Newark: International Reading Association.

Littleton, K., Wood, C., & Chera, P. (2006). Interactions with talking books: Phonological awareness affects boys' use of talking books. *Journal of Computer- Assisted Learning, 22*(5), 382–390.

Lovell, M., & Philips, L. (2009). Commercial software programs approved for teaching reading and writing in the primary grades: Another sobering reality. *Journal of Research on Technology in Education, 42*(2), 197-216.

Luo, T., Lee, G-L., & Molina, C. (2017). Incorporating istation into early childhood classrooms to improve reading comprehension. *Journal of Information Technology Education: Research, 16*, 247-266.

Macaruso, P., & Walker, A. (2008). The efficacy of computer-assisted instruction for advancing literacy skills in kindergarten children. *Reading Psychology, 29*, 266–287.

Macaruso, P., Hook, P. E., & McCabe, R. (2006). The efficacy of computer-based supplementary phonics programs for advancing reading skills in at-risk elementary students. *Journal of Research on Reading, 29*(2), 162-172.

Mann, V. (1987). Measuring phonological awareness through the invented spellings of kindergarten children. *Merrill Palmer Quarterly, 33*, 365-69.

Mayer, R. E. (2010). Techniques that reduce extraneous cognitive load and manage intrinsic cognitive load during multimedia learning. (R. Moreno, Ed.). J. L. Plass, R. Moreno and R. Brünken (Eds.), in *Cognitive load theory* (p. 131-152). Cambridge University Press

McKenna, M. C., Kear, D. J., & Ellsworth, R. A. (1995). Children's attitudes toward reading: A national survey. *Reading Research Quarterly, 30*(4), 934-956.

McKenna, M., Reinking, D., Labbo, L., & Kieffer, R. (1999). The electronic transformation of literacy and its implications for the struggling reader. *Reading and Writing Quarterly, 15*, 111-126.

McMillan, J., & Schumacher, S. (1997). *Research in education: A conceptual introduction* (4th ed.). Boston: Addison Wesley Longman, Inc.

Musti-Rao, S., Lo, Y., & Plati, E. (2015). Using an ipad app to improve sight word reading fluency for at-risk first graders. *Remedial and Special Education, 36*(3), 154-166.

Nunes, T., Bryant, P., & Barros, R. (2012). The development of word recognition and its significance for comprehension and fluency. *Journal of Educational Psychology, 104*(4), 959–973

Organisation for Economic Co-operation and Development [OECD]. (2010). *PISA 2009 results: What students know and can do—Student performance in reading, mathematics and science*. OECD.

Orhan Karsak, H. G. (2014a). Bilgisayar destekli ilk okuma yazma öğretimine ilişkin öğretmen görüşlerinin incelenmesi [Examination of teachers' views on computer-assisted initial literacy teaching]. *Akademik Bakış Uluslararası Hakemli Sosyal Bilimler Dergisi* (40), https://dergipark.org.tr/en/pub/abuhsbd/issue/32926/365761

Orhan Karsak, H. G. (2014b). Bilgisayar destekli öğretimin ilkokuma yazma başarısına etkisi [The effect of computer-assisted teaching on initial literacy achievement]. *Journal of Theoretical Educational Science, 7*(1), 114-134.

Özdemir, K. (2017). Sınıf Öğretmenlerinin birinci sınıf yazma öğretimi sınıf içi uygulamalarına ilişkin görüşleri [Primary school teachers' opinions on classroom practices used in initial literacy teaching]. *Academy Journal of Educational Sciences*, *1*(1), 55-72.

Özerbaş, M. A., & Güneş, A. M. (2015). Sınıf Öğretmenlerinin ilkokuma yazma öğretimi sürecinde eğitim teknolojilerini kullanmaya yönelik görüşleri [The views of primary school teachers concerning the use of educational technologies in teaching in the initial reading and writing process]. *Kastamonu Education Journal, 23*(4), 1775-1788.

Özmen, B, Koçak Usluel, Y., & Çelen, F. (2014). Integration of information and communication technologies into the teaching-learning process: Existing situation and trends in the literature. *Journal of Theory and Practice in Education, 10*(5), 1224-1253.

Palaiologou, I. (2016). Children under five and digital technologies: implications for early years pedagogy, *European Early Childhood Education Research Journal, 24*(1), 5-24.

Patton, Q. M. (1987). *How to use qualitative methods in evaluation*. California: Sage Publications.

Pennington, B. F., & Lefly, D. L. (2001). Early reading development in children at family risk for dyslexia. *Child Development, 72*(3), 816–833.

Pullen, P. C., & Justice, L. M. (2003). Enhancing phonological awareness, print awareness, and oral language skills in preschool children. *Intervention in School and Clinic, 39*(2), 87-98.

Rasinski, T. (2006). Reading fluency instruction: Moving beyond accuracy, automaticity and prosody. *The Reading Teacher, 59*(7), 704-706.

Roblyer, M. D., & Doering, A. H. (2014). *Integrating educational technology into teaching*. New York: Pearson.

Rubba, J. (2004). Phonological awareness skills and spelling skills. Retrieved on http://cla.calpoly.edu/~jrubba/phon/phonaware.html

Scarborough, H. S. (1990). Very early language deficits in dyslexic children. *Child Development, 61*(6), 1728-1743

Sorrell, C. A., Bell, S. M., & McCallum, R. S. (2007). Reading rate as a function of computerized versus traditional presentation mode: A preliminary study. *Journal of Special Education Technology, 22*(1), 1-12.

Sorrell, C. A., Bell, S. M., & McCallum, R. S. (2007). Reading rate as a function of computerized versus traditional presentation mode: A preliminary study. *Journal of Special Education Technology, 22*(1), 1–12.

Soydaş, B., & Ertem, İ. S. (2019). Dijital metinleri tekrarlı okumanın ilkokul 4. sınıf öğrencilerinin akıcı okuma ve anlama becerileri üzerine etkisi [The effect of repeated reading of digital texts on fluent reading and comprehension skills of primary school 4th grade students]. *Social Mentality and Researcher Thinkers Journal, 5*(26), 1987-2005.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. B. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology, 38*, 175-190.

Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education, 94*, 252–275.

Şahin, F., & Çakır, R. (2018). Çoklu ortam materyallerinin okuma-yazma güçlüğü çeken öğrencilerin okuma-yazma becerileri üzerinde etkisi [The effect of multimedia materials on the literacy skills of students with literacy difficulties]. *Journal of Instructional Technologies & Teacher, 7*(2), 75-90.

Şentürk Leylek, B. (2018). *İlkokul üçüncü sınıf öğrencilerinin okuma becerilerinin gelişiminde ve okumaya yönelik tutumlarında dijital hikâyelerin etkisi* [The effect of digital stories on the development of primary school third grade students' reading skills and attitudes towards reading (Unpublished Doctoral Dissertation)]. Bursa Uludağ University Institute of Educational Sciences, Bursa.

Taşkaya, S. (2010). Okuma problemlerinin giderilmesinde renkli metinlerin etkisi [The effect of colored texts in solving reading problems]. Ondokuz Mayıs University Journal of Education Faculty, *29* (2), 21-36.

Uğurlu, C. (2009). İlköğretim birinci sınıf öğretmenlerinin yapılandırmacı öğrenme yaklaşımı ile ilk okuma yazma öğretimine ilişkin görüşleri [Views of primary school teachers on the constructivist learning approach and initial literacy teaching]. *Electronic Journal of Social Sciences, 8*(30), 103-114.

Usluel, Y., & Yıldız, B. (2012). Bilgi ve iletişim teknolojilerinin öğrenme öğretme sürecine entegrasyonu: süreçle ilgili kontrol listesinin geliştirilmesi [Integration of information and communication technologies into the learning-teaching process: developing a process-related checklist]. Presented at the 10th National Science and Mathematics Education Congressi, 27-30 June 2012, Niğde University, Niğde.

Usluel, Y., Özmen, B., & Çelen, K. (2014). Integration of information and communication technologies into the teaching-learning process: existing situation and trends in the literature. *Journal of Theory and Practice in Education, 10*(1), 1-23.

Yıldız, S. (2010). İlkokuma yazma öğretiminde çoklu ortam uygulamalarının okuma becerisi üzerinde etkililiği [The effect of multimedia applications on reading skills in initial literacy teaching]. *Bolu Abant İzzet Baysal University Journal of Graduate School of Social Sciences 10*(2), 31-63.

Yılmaz, E., & Dikici Sığırtmaç, A. (2008). İlköğretim birinci sınıfa devam eden çocukların ilk okuma yazmaya geçiş sürelerinin okul öncesi eğitim alma durumuna göre incelenmesi [Investigation of primary school first-grade students' time of transition to reading depending on their status of having pre-school education]. *Contemporary Education, 349*, 30-36.

Yunus, M. M., Nordin, N., Salehi, H., Sun, C. H., & Embi, M. A. (2013). Pros and cons of using ICT in teaching ESL reading and writing. *International Education Studies, 6*(7), 119-130.

Zheng, B., Warschauer, M., Lin, C. H., & Chang, C. (2016). Learning in one-to-one laptop environments: A meta-analysis and research synthesis. *Review of educational research, 86*(4), 1052-1084.

Zipke, M. (2017). Preschoolers explore interactive storybook apps: the effect on word recognition and story comprehension. *Educ Inf Technol*, *22*, 1695-1712.