

The Effectiveness of Digital Literacy Training to Improve Early Childhood Education Teacher's Competence

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Abstract

In the digital era, students are interested to use computers in their learning activities. To fulfill this need, teachers need to improve their digital literacy competencies to enable them to seize the digital media for teaching and learning activities. The purpose of this study was to determine the effectiveness of digital literacy training in improving teachers' competence of Early Childhood Education in Pontianak City, West Kalimantan Province. Their digital literacy competencies cover their ability to use digital media, search for information sources via the internet, deal with hypertext guidance, evaluate information content and prepare online-based knowledge. The training was carried out for 2 days and it delivered task "Project Teaching" for the trainees. This study used a pre-experimental method with One Groups Pretest-Posttest Design. The sample used was 55 teachers from various regions in the city of Pontianak by using purposive sampling technique. Data were collected using techniques like interviews, observation and pretest-posttest. The data were analyzed by applying quantitative approach, namely the inferential statistical test assisted by SPSS 25. The results showed that the average pre-test score was 46.27 and the post-test average score was 88.91. The results shows that digital literacy training is effective in improving the teachers' competence. The effectiveness of this digital literacy training is supported by the available facilities and infrastructure and support from their respective institutions.

Keywords: Digital Literacy Competence, Early Childhood Education, Training, Teacher

Introduction

In everyday life, the role of digital technology has increased and (Bekker et al., 2015). Digital technology has been closely related with information and communication technology that has driven changes in aspects of daily life, including the education sector (Lestari, 2018). In education sector, policymakers and teachers have shown their interest and appreciated the potential of digital technology to revolutionize education systems (Blackwell et al., 2014). It is widely known that technology has played significant role in the learning process. One of the roles that information technology plays is to support the students' achievement for their learning outcomes.

Technology can be used optimally by the teachers to meet their students' needs both in formal and non-formal education including Early childhood education (ECE) (Misyana et al., 2021). The use of information and communication technology (ICT) in education encourages and challenges the teachers at the same time to improve their digital literacy competence. Given this circumstance, our society today and in the future is in a position to develop digital literacy in education. Schools are required to promote digital literacy which is the crucial skill to develop for life (From, 2017; Garzón-Artacho et al., 2021). Several studies have reported the issue of digital litera-

cy. Their results include technical skill can affect teacher's confidence in teaching (Blackwell et al., 2014, 2016), digital literacy skills should be demonstrated in teaching and learning (Bekker et al., 2015), digital competency training is one of the challenges that must be addressed by teachers (Garzón-Artacho et al., 2021). The studies have shown that the teachers are required to develop their digital literacy skills to teach.

While children are called digital natives since they are glued to their screen, teachers belong to digital immigrant category (Prensky, 2001). In the digital era, teachers are challenged to develop their digital literacy to meet the educational need. They are expected to be able not only to teach but also to be able to build effective relationships with their students using technology. Their digital literacy supports them to improve their quality of teaching (Darling-Aduana et al., n.d.). To achieve their professionalism, they must be able to seize digital competencies (Tømte et al., 2015). However, there are obstacles that the teachers may encounter to be able to achieve digital literacy skills. In Indonesia, the teachers lack digital awareness and knowledge (Rahmah, 2015). Most of them currently are struggling to deal with digital literacy. They are still experimenting with various existing technologies and their effort may take a long time (Zulham, 2014). Their digital literacy skill can be considered low (Lucas et al., 2021).

The present study has conducted preliminary research in Pontianak city. It was implemented to determine the ECE teachers' skills regarding digital literacy in their learning process. Researchers distributed questionnaires and found 33 teachers or 64.70% of 51 teachers have weaknesses in mastering digital literacy. The 33 teachers most of them belong to digital immigrants and they have been teaching for more than 10 years. They demonstrated low digital literacy skill and they were unable to use digital media. They also experienced difficulty in finding information sources via the internet, understanding of Hypertext directions, evaluating information content and creating online-based knowledge. Based on this result, ECE teachers in Pontianak city need a training that can improve digital literacy competencies.

The ability to use digital media in teaching and learning is part of the teachers' Pedagogic competence and Professional competence. When it comes to teacher's professionalism, the government has issued Law Number 12 CHAPTER II Article 7 of 2005 and is further elaborated in the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 137 of 2014 concerning National Education Standards for ECE. National Standards for ECE governs the implementation and management of ECE in all jurisdictions of the Unitary State of the Republic of Indonesia. In line with this regulation, teachers should have digital literacy competencies because they deal with teaching and learning activities in the digital era. Teachers in their professional duties are entitled to opportunities to improve their competence and obtain training and development (Government Regulation Number 137 of 2014). The Digital Literacy Movement in schools has been initiated by the government. It has responded delivered various activities such as inviting credible speaker to train teachers, sending teachers to attend training activities, holding seminars and workshops on technology.

Digital literacy skill refers to several abilities including to localize, systematize, assess and analyze information using digital technology (Zhao et al., 2018). This skill has attracted scholars to investigate the issue. Several researchers have investigated the issue. Martin & Grudziecki (2006) reported the importance of improving digital literacy skills by developing concepts and tools. Lotherington & Jenson (2011) revealed the importance of digital-based teaching as a new breakthrough in literacy. Gruszczynska & Pountney (2013) explored the importance of digital literacy concept development in the context of schools and teachers. Tahsin Üstündağ et al (2017) investigated the need

for digital literacy adaptation in pre-service teachers. Pratolo & Solikhati (2020) reported that the teachers should have digital literacy which is important to enable them to finding sources of information for their teaching activity. To achieve digital literacy competence, teachers can take a training. There are some reasons why training for digital literacy is needed for the teachers. They are expected to have the competence to participate in various fields in the social life. Professionally speaking, they should perform best in their teaching by the assistance of digital technology. Being able to use digital technology helps them to build strong pedagogy to improve student learning and facilitate their digital competence (Krumsvik, 2014; Redeker, 2017).

There are some studies concerning digital literacy training particularly for the teachers. Tomczyk (2020) reported that training for digital literacy should enable the teachers to experience e-learning, to participate in online classes, to search information on the Internet, to participate in e-learning courses, and to participate in informal study groups. In the same vein, other studies encourage and support the digital literacy training for the teachers and the support in terms of the innovation in facilities and infrastructure (Kerkhoff & Makubuya, 2022; Li & Yu, 2022). Training digital literacy encompasses several components. It should assist teachers in preparing online teaching plans in terms of media and online teaching materials (Sánchez-Cruzado et al., 2021). The program should provide teachers opportunities to develop their competency, develop the basis for new models for the development of new learning models and establish their digital knowledge formation (Liu et al., 2020). The training should contribute to their competence to optimize a learning environment, learning strategies, digital tools and applications for their professional development (Kim, 2019; Kim et al., 2021).

Objectives of the Study

However, there is a little information on digital literacy training for ECE teachers in Indonesia particularly in Pontianak city, West Kalimantan. This study tries to fill the gap. It investigates the effectiveness of digital literacy training to improve the ECE teachers' competence. Specifically, this study investigated ECE teachers' digital literacy competence prior to digital literacy training. It also sought to explore the effectiveness of digital literacy training on the teachers' competence includes the ability to use digital media, find sources of information via the internet, navigate hyperlink, evaluate of information, and create online-based content for teaching and learning.

Theoretical Framework

Digital literacy can be defined as a dynamic competency and it develops over time. The literacy varies across contexts (Greene, 2018). When it comes to computer use, this literacy refers to user's ability to understand, use information in various formats from various sources (Gilster 1997; Gruszczynska & Pountney, 2013). In terms of its dimension, digital literacy has three dimensions: technical, cognitive and socio-emotional. First dimension requires person to have technical and operational skills to use ICT for learning and daily activities. The second dimension brings user to the next level that is the ability to think critically in finding, evaluating, and handling digital information. Finally, the last dimension addresses users' ability to use the internet responsibly to communicate, socialize and learn (Nawaz et al., 2010; Ng, 2012; Tahsin Üstündağ et al., 2017).

There are some indicators of digital literacy. In terms of the device, it can be seen from the individual's adaptation to new or developing technologies (Ng, 2012). Teachers can use laptops and tablets as a means to demonstrate their digital literacy (Gruszczynska & Pountney, 2013). With the advance of smartphone capacity, teachers can optimize the use of smartphones in a creative way in teaching to indicate their digital literacy (Daniel Oriogu et al., 2018). They should have the ability to use various device when it comes to gadget to use for teaching. They should be provided with

various forms of technology for teaching to explore their digital literacy competence (Pratolo & Solikhati, 2020). In addition, the ability to use social networking sites and the internet to search for information have been considered as the indicators of digital literacy competence (Burnett, 2011). Digital literacy training for ECE teachers are expected to develop their competence in accessing, managing, understanding, integrating, communicating, evaluating, and creating information safely and appropriately through digital technology (Anisimova, 2020).

Methodology

Research Design

To investigate the effectiveness of digital literacy training, the present study applied quantitative approach. It used Pre-experimental method with One-Groups Pretest-Posttest Design (Creswell & Creswell, 2017). The design of the research is as follows:

O1 X O2

Notes:

O1: *pretest*

X : *treatment* (digital literacy training)

O2 : *posttest*

Research Site and Subjects

This research was conducted in ECE schools that were located in several districts in Pontianak city, namely Pontianak City, South Pontianak, Southeast Pontianak, East Pontianak, West Pontianak and North Pontianak District. The subjects of this research were teachers in the chosen ECE schools and the school principals who represent every district. The sample involved was 55 participants. Purposive sampling was applied. In other words, there were some criteria put forward before determining the sample. The criteria were set for determining ECE institution and the teachers who were taken as research participants.

ECE institutions that were chosen as sample met the following two criteria: they have been accredited at least B and they were recommended by the Pontianak City Education Office and HIM-PAUDI (the ECE teacher association). The teachers who were chosen as sample in this study met several criteria: (1) they are able to operate at least Microsoft office programs; (2) they have laptops and internet networks; (3) they belong to in-service teacher at their ECE institutions, (4) They live near to the training center so they can attend training on time and (5) they are willing to take part and to complete tasks independently in the training.

Research Procedures

This training program was administered through several stages namely pretest, face-to-face learning, teacher projects, and posttest. In detailed, the procedures can be illustrated in the following chart

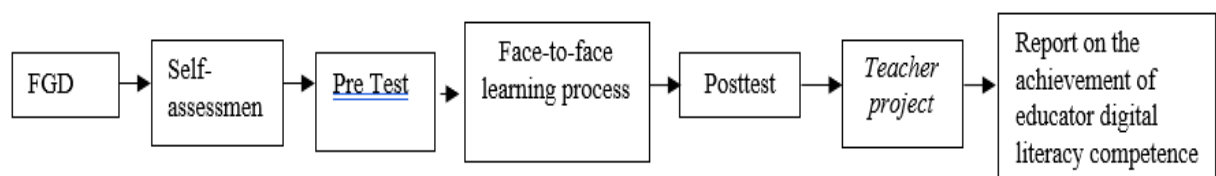


Chart 1. Research Procedures on the Effectiveness of Digital Literacy Training to Improve the ECE Teachers' Competence

Data collection technique

Data were collected using observation, pretest and posttest. Those techniques allow researchers to measure more complex learning outcomes, the effectiveness of the training, the increase of teachers' competence in digital literacy before and after participating in the training.

Research Instrument

To collect the data, the researchers construct the guidelines for digital literacy skills. There are several constructs namely (1) using digital media (2) searching internet (3) navigating hyperlink (4) evaluating information and (5) constructing knowledge. There are several statements made to meet each construct. The detailed description can be seen in the table 1.

Table 1. Instruments for assessing the ECE Teachers' digital literacy skills

No	Statements	Responses	
		Y	N
Using Digital Media			
1	Ability to use digital media in teaching		
2	Ability to use word processing, numbers and presentations, such as Microsoft Word, Excel, and Power Point in teaching		
3	Ability to use several forms of online publishing, such as WordPress, BlogSpot, YouTube, SlideShare in teaching		
4	Ability to use social networks, such as Instagram, Telegram and Facebook in teaching		
5	Ability to use digital learning resources, such as electronic books (e-books)		
Searching Internet			
6	Ability to find information through online digital media		
7	Ability to use search engine google to search information for teaching material		
Navigating hyperlink			
8	Ability to use link on digital media online		
9	Ability to use browser in internet to search teaching material		
10	Ability to use web to search information		
11	Ability to use specific keywords to search information		
Evaluating Information			
12	Ability to analyze information available on a particular online digital media		
13	Ability to analyze information on a particular link available on online digital media		
14	Ability to compare several web addresses that can be used as a source for teaching		
15	Ability to analyze web addresses that can be used for sources of teaching		
16	Ability to ask questions and find the answer by looking at FAQ (<i>Frequently Ask Question</i>).		
Constructing Knowledge			
17	Ability to create content, news, information using an account in an online digital media		
18	Ability to re-check information available in online digital media		

No	Statements	Responses	
		Y	N
19	Ability to use all the media to check the truth of a particular information		
20	Ability to use information they have found to discuss with their peer		

Notes: Y : Yes, to indicate that the teachers have the ability for each statement

N : No, to indicate that the teachers do not have the ability for each statement

Data Analysis Technique

To test the hypothesis, the researchers applied One Sample Kolmogorov Smirnov normality test which was first carried out by using SPSSv.25. The normality test was conducted to determine whether or not the gain or difference between the pretest and posttest scores was normally distributed. After carrying out the normality test and achieving the data that were normally distributed, the researchers analyzed the difference in average scores before and after the participant took a part in the training. A t-test using the Paired Sample t test was applied.

Results

This study investigates the effectiveness of digital literacy training to improve teachers' competence. In this section, the data will be described to achieve the purposes of the present study.

Normality test for pretest and posttest

The first data concerns normality test. The test was aimed at determining whether or not the gain or difference between the pretest and posttest scores is normally distributed. There are some criteria for administering the normality test One Sample Kolmogorov Smirnov. If the value of Sig (Significance) or probability value < 0.05 the distribution will be considered not normal. Whereas if the value of Sig. (Significance) or probability value > 0.05 the distribution will be considered normal. The results of the data normality test are as follows:

Table 2. Normality test for pretest and posttest

		Pretest	Posttest
N		55	55
Normal Parameters ^{a,b}	Mean	46,27	88,91
	Std. Deviation	14,376	9,656
Most Extreme Differences	Absolute	,165	,220
	Positive	,165	,166
	Negative	-,139	-,220
Test Statistic		,165	,220
Asymp. Sig. (2-tailed)		,093^c	,200^c

Table 2 above shows the results of calculation at the 95% confidence level. The significance value for the pretest is 0.093 and for the posttest is 0.200. Based on the data of normality test criteria, the calculation has a significance value (sign) more than 0.05, so the total gain is normally distributed.

Hypothesis testing

Applying the normality test, the present study achieved the data with normal distribution. Given this result, the researchers analyzed the difference in the participants' average scores before

and after they took a part in the training. A t-test using the paired sample t-test was applied. The results of the hypothesis testing can be seen in table 3.

Table 3. Correlation test for Pretest dan Posttest

	N	Correlation	Sig.
Pair 1 Pretest&Posstest	55	,244	,030

Table 3 above shows the results of the correlation between the two variables. The result of the correlation shows $0.030 < 0.05$, meaning that there is a significant correlation between the teachers' digital literacy competencies before and after training.

Table 4. Hypothesis Testing for Pretest and Posttest

Paired Differences									
		Mean	Std.Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pret-est-Post-test	42,636	15,240	2,055	46,756	38,516	12,747	54	,000

Table 4 above shows the result of hypothesis testing for pretest and posttest. The test was carried out to find out whether or not the teachers' average digital literacy competence score before and after training is the same. The score can be bigger or smaller. The results of the above calculation show that the t-count value is 12.747.

Gain Test

Gain test was conducted to provide an outline of the increase in learning outcomes scores before and after being given treatment in the form of training. In table 5, the categories for the gain is set.

Table 5. Categories for Gain Effectiveness

Percentage	Interpretation
< 40	Not effective
41 – 55	Less effective
56 – 75	Quite Effective
> 76	Effective

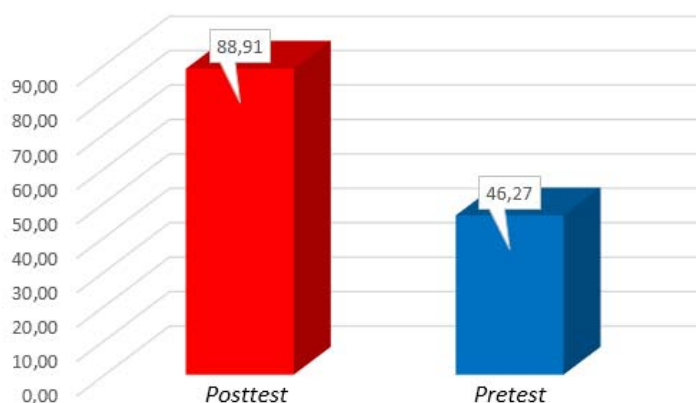
Source: Hake (1999)

For the pretest, the score results which were obtained from 55 respondents show a total score of 2545. The average score is 46.27. While the highest score is 65, the lowest score is 20. In the posttest, the score results which were obtained from 55 respondents is 4890. The average a score is 88.91. While the highest score is 100, the lowest score is 60. The following table 6 displays the average pretest and posttest scores.

Table 6. Mean for Pretest and Posttest Score

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
pretest posttest	55	46,27	14,376	20	65
	55	88,91	9,656	60	100

Based on the average pretest and posttest scores in table 2, the following graph 1 illustrates the average pretest and posttest scores.

**Graph 1. Mean of score for Pretest and Posttest**

Based on the results of the gain test calculation, it can be concluded that the average score in posttest gain score is higher than the pretest average score. This result falls into effective category.

Discussion

In the previous section, the present study has shown that digital literacy training is effective to improve teachers' competence. This can be seen from the participants' increase in terms of skills, knowledge, and expertise after they joined the training. The results of the present study is in line with previous studies reporting that the training develops teachers' readiness to use and teach with today's information and communication technologies (Røkenes & Krumsvik, 2014; Tømte et al., 2015); improve the teachers' digital literacy competence so that they are able to integrate technology into classroom learning (Tondeur et al., 2012).

In the present study, the content of the training was designed to achieve digital literacy competences. Any training should take into consideration the competencies to achieve (Xie et al., 2017). In this research, the training was conducted on a project basis. The participants were assigned to create application-based online learning media that is uploaded to YouTube. This strategy was carried out so that participants are proficient in making digital-based media. This is in line with the previous studies. Their results show that various digital literacy training strategies can be carried out by using project-based (Brinkerhoff, 2006), mentoring (Kopcha 2012), experimenting on professional development programs, and general instructional technology courses (Mouza, 2011; Xie et al., 2017).

A particular training program is considered effective if its process is enjoyable and satisfying for the trainees. When the trainees find a training program interesting, they will be motivated to

learn and practice what they receive. In this research, to determine participants' satisfaction in the implementation of the training, the instrument in form of questionnaire and interviews were administered. They investigated the training effectiveness in the implementation process by asking participants several questions.

In this present study, the teacher project in the training includes an attitude aspect in the selection of information as a form of attitude towards digital literacy. The final assessment of this training focused on the results of the teacher project. In the project, participants worked on a product in the form of digital literacy by utilizing social media Instagram and online publishing media such as YouTube. In the training, the teachers demonstrated their digital literacy competencies that are expected to develop their pedagogic and professionalism. Teachers have their distinctive digital literacy competencies to meet their teaching needs which are certainly different from the competencies expected from the public in general (Reisoğlu, 2021).

The teachers inherently serve as role models to develop and facilitate students' development on digital literacy competencies. This can be done in the classroom where the teachers make pedagogical decisions. What they decide to use a particular model in applying digital technology enhances learning opportunities for students to achieve the learning outcomes (Krumsvik, 2014). Teachers' digital literacy competence refers to the way they use digital device in teaching that facilitates to some extent their students' active involvement to seize digital technology in their lives and future careers (Redecker, 2017). These digital literacy competencies require the development of new pedagogical practices and organizational strategies on the part of the teachers. They should be designed for educational use in teaching and learning within a brand-new framework. New framework should be proposed to determine sort of digital competencies that must be mastered by ECE teachers so that they are able to integrate them in learning. This notion is in line with the findings of the previous studies conducted by researchers (Hatlevik, 2017; Kelentrić, et al. 2018).

In the context of ECE, teachers who have ample sufficient digital literacy competencies exhibit their innovation in their role as educators. They facilitate students for more student-centered learning to achieve the objectives of learning (Esteve-Mon et al., 2020). The role of mentors should be optimized by the teachers when they seize their digital literacy competence in teaching (Riviou et al., 2014). These digital competencies are indispensable for the teachers to work best in learning today. It goes without saying that there must be a special training program for the teachers to improve these competencies so that their performance in teaching process gets optimal results (Blayone et al., 2018). In a nutshell, ECE teachers must be proficient and literate in terms of digital literacy to meet the needs of their students who are digital natives (Cazco et al., 2016).

This study promotes digital literacy competency for ECE teachers particularly. These competencies are critical for every ECE teachers in the 21st century. They are expected to be able to engage on a global platform where it is imperative for today's teachers to integrate technology into their professional practice. Technology integration in teaching is necessary and it requires an update to hone teachers' digital skills to meet the needs of today's learning world and future challenges (Esteve-Mon et al., 2020). Digital literacy training should nurture the awareness, attitude and ability to use appropriate technological tools in education. The training should develop participants' ability to identify, access, critically evaluate, manage, integrate and synthesize digital resources for their teaching activities. In addition, the teachers are challenged to build new knowledge and at the same time they express and communicate their ideas in a variety of digital media and formats to develop their students' learning outcomes (Esteve-Mon et al., 2020).

The present study contributes to the body of knowledge of digital literacy training for ECE teachers to improve their digital literacy competences in Indonesian context particularly in Pontianak city. Based on the results of this study, particularly it can be used as an evaluation for the implementation of further digital literacy training. The results of this study can be used as guidelines that can be used as a training curriculum for ECE teachers in particular. However, there are some limitations of the present study in terms of method. Further research is suggested to investigate the issue using mix method to gain robust result.

Conclusion

The present study investigates the effectiveness of digital literacy training for ECE teachers. Based on the results of the study, some conclusions can be drawn. The effectiveness of literacy training to improve the ECE teachers' digital literacy competence can be seen from the gain test. The participants' average posttest gain score is higher than their pretest average score. This result fall into the effective category because it shows a significant difference in the participants' increase in digital literacy results before and after they joined the training.

The teachers' success in this digital literacy training is supported by their initial knowledge and insight in digital literacy competencies. Their knowledge covers the ability to operate a computer, to find information by using the internet, to use various applications and the availability of digital infrastructure owned by teachers or provided by the institution. Their participation in the training enables them to improve their pedagogic and professional competencies to meet educational needs in the digital era. Teachers are able to explore various uses of digital media in providing information in the form of learning materials with digital competencies. They are suggested to further actively participate in professional development both through formal education and professional development activities such as workshops or seminars in digital literacy. This digital literacy training is useful for ECE teachers to gain knowledge and skills as well as gain recognition of their competence (certified) by professional certification bodies.

Recommendations

This research only focuses on the effectiveness of literacy training to improve the digital literacy competence of ECE teachers. There are still shortcomings, namely in determining the overall material that can still be explored in using or utilizing other digital media. For further study, it is expected to include a post-training assessment and monitoring tool where participants carry out the teaching and learning process in class with their real students. Training institutions and courses and the education office need to conduct studies on the competence of teachers with respect to digital literacy competencies, developments regarding the latest materials, and the suitability of the cognitive and psychomotor domains that must be mastered in each digital literacy competency. The teachers are expected to be able to apply various platforms according to the needs and developments of the times.

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