



# Techno-Pedagogy Model Development: Can Techno-Pedagogy Learning Improve Digital Literacy

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**Abstract.** The purpose of this research is to develop a techno-pedagogy-based educational model to improve digital literacy skills. This research uses mixed methods. The research design is explanatory starting with qualitative development and testing the results of quantitative development. The research sample is students at one of the teaching universities in West Java. Data collection by questionnaires, tests, and observations. Data analysis was carried out using the Miles & Huberman model on qualitative data and carried out the mean difference with the t test on quantitative data. The results of the analysis show that the results of the development of a techno-pedagogy-based educational model have good quality based on testing the effectiveness and usefulness of the model. This model also has a good influence on students' digital literacy skills. The research recommendation is that further research is needed to package the model in better technology.

**Keywords:** Literacy digital · pedagogy · technology · techno-pedagogy

## 1 Introduction

The development of the world at this time has been in a period that cannot be avoided from technological developments. Technology and information drive changes in systems related to the economy, education, and welfare, raising challenges that must be faced, namely the formation of new types of social structures [1]. Almost in all sectors of life technology has entered and become an inseparable part [2]. However, technological developments also have a negative impact if they cannot be adapted properly by the community, including the emergence of an attitude of wanting to be fast-paced in everything, starting to fade local cultural values that develop in society, many emerging

digital-based crimes, decreasing values -moral values that develop in society, as well as the growth of lazy nature [3].

Reflecting on the disorientation of digitalization and the industrial revolution 4.0 which places too much emphasis on reforestation rather than humanization, a new concept is needed that can improve not only the world and the spirit of technology, but also the world and the spirit of humanity itself. Society 5.0 is a development that focuses on humans, in contrast to the spirit of the industrial revolution 4.0 which is too focused on technology. In line with this, Salgues [4] also stated that in the era of society 5.0, the world needs people who are adaptive, responsive, and transformative. The same thing was conveyed by [5] who said that the Industry 4.0 paradigm was understood as focusing on the creation of 'smart factories', while Society 5.0 led to the creation of the world's first 'super-smart society'.

In the midst of the development of information and communication technology, the awareness of education students is currently experiencing a crisis. Robandi et al. [6] in his research concluded that the level of awareness of education students on educational phenomena is still at the magical and naive level, the percentage reaches 65%. These two levels of awareness are certainly not in accordance with the ideal student awareness profile.

Responding to these factual conditions, within one year the research team tried to reduce these problems by making efforts to develop competencies in the field of critical pedagogy that could be used as philosophical and didactic-methodical footholds to develop the lecture process in higher education.

We all know that the development of technology has a real impact on the world of education. Therefore, the world of education must also make new breakthroughs related to the use of technology in learning. The main actor who is directly affected by this is an educator. Educators have an obligation to transfer knowledge to students using innovation in every lesson [7]. However, one of the main problems facing the Indonesian nation today is the low pedagogical competence of Indonesian educators caused by mechanical and traditional learning cultures. One indicator of low pedagogical competence is the low skill of educators in utilizing technology. In fact, it is not only included in one of the indicators of pedagogic competence, skills in utilizing technology are also included in the social and professional competencies of educators [8]. Therefore, these competencies are very fundamental for educators to have. In addition, when technology advances, it has the potential to make children satisfied with the knowledge they have acquired. This is a challenge for education in Indonesia, especially for universities.

Schoen and Fusarelli [9] in their research say that the pedagogical competence of teachers and the use of information and communication technology as an instructional tool can help meet the challenges of preparing students to improve the skills needed in the 21st century. One of the skills that students need to develop and possess in line with this is digital literacy. This must be an important concern for all educators at various levels, especially educators at the higher education which is an institution that educates prospective educators, where they need to set the right example for their students. Currently, one of the most important ways to integrate the use of technology in learning is to use a frame of mind to integrate complex problems of content knowledge, pedagogy, technology and various forms of elements that support learning in the classroom [10, 11].

In this study, the development of students' digital literacy will be integrated in critical pedagogics. In the digital context, this presents a new and unique set of challenges, especially related to literacy skills [12]. Efforts to develop student digital literacy based on critical pedagogy must of course be supported by the development of various dimensions in its implementation, so that it can be realized as expected. The development of critical pedagogy-based learning is believed to be able to provide answers to the changing times that began to be technology-based in Indonesia.

## 2 Methods

The research model used in this study is a mixed methods research model with an explanatory design combined with development research using the RnD model. In the explanatory design, there are two research approaches that are combined in this study, namely qualitative and quantitative approaches. The qualitative approach in the research was carried out with the aim of searching for literature in developing the model. In this qualitative approach, a model is developed. The results of the model development are then tested and seen for quality with a quantitative approach. This research was conducted with a one-group pretest-posttest design.

### 2.1 Subject and Data Collection

The subjects of this study were students at a university in West Java who contracted basic education courses. The sample selection was done by random sampling. The data in this study will be collected using several data collection techniques, namely questionnaires, tests, and observations. Based on this data collection technique, the data that will be generated in this study include qualitative data and quantitative data (Table 1).

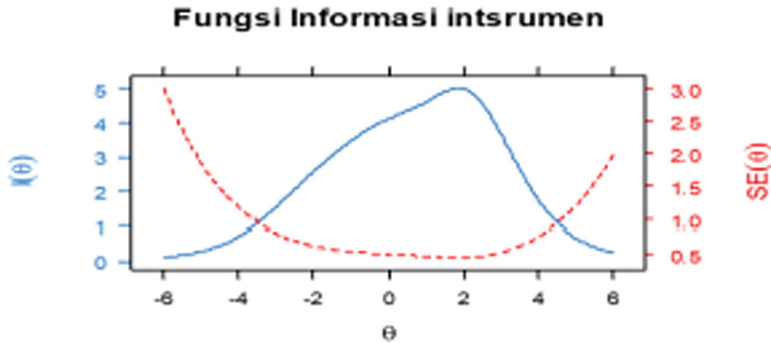
### 2.2 Subject and Data Collection

Digital literacy instruments have difficulty parameters, namely at intervals of  $-2$  to  $2$ . The range of the results of this study shows that the level of instrument difficulty for item response theory [13, 14]. The items in this techno-pedagogy development model instrument have relatively the same level of difficulty and all items fit, so the test can be continued.

Figure 1 informs the information function of students' abilities for digital literacy instruments. The results of the analysis show the quality of digital literacy instruments on students' abilities. Figure 1 shows that the highest probability of answering is a student of ability 2 with the lowest standard error. Based on the graph, the average ability that has the probability of answering is  $-2$  to  $4$ . While the abilities of  $-6$ ,  $-4$ , and  $6$  are less suitable for this digital literacy instrument as evidenced by a higher standard of error than the probability of answering the questions.

**Table 1.** Instrument Characteristic

Items	a	b1	b2	b3	Location
Access1	1,00	-2,58	-1,79	0,06	-1,44
Access2	1,00	-2,61	-0,92	0,87	-0,89
Analyze1	1,00	-2,27	-0,60	0,84	-0,68
Analyze2	1,00	0,18	2,13	1,84	1,38
Create1	1,00	0,18	2,52	2,15	1,62
Create2	1,00	-0,19	1,84	2,77	1,47
Reflect1	1,00	-0,23	2,69	2,85	1,77
Reflect2	1,00	-0,25	2,29	3,18	1,74
Act1	1,00	-0,96	1,30	1,95	0,76
Act2	1,00	-0,13	2,86	2,98	1,90



**Fig. 1.** Information Function of Instrument

**2.3 Data Analysis**

Qualitative data are used as the basis for developing the model. This is analyzed qualitatively with the Miles & Huberman model [15] namely presenting, reducing, and concluding data. The results of this analysis are used for development. The resulting quantitative data will be analyzed using the mean difference test, namely the difference test (t). The stages of quantitative data analysis using statistical techniques are carried out in several stages of data analysis. These stages are descriptive data analysis, normality and homogeneity test analysis of data, and analysis of difference test with t test.

### 3 Result and Discussion

#### 3.1 Technology-Based Education Model

The techno-pedagogy-based education model can be proven based on content validity, construct validity, reliability, and good instrument characteristics. After all the test conditions are met, the illustration in Fig. 2 is obtained.

The test results resulted in the design of a techno-pedagogy-based education model consisting of learning potential, social media activities, and social environment. This model can improve students' digital literacy skills, which consist of access (access), analyze (analysis), create (create), reflect (reflection), and act (action).

The education model based on the techno-pedagogy approach in this research is implemented in the form of developing a digital learning platform in the form of an e-course. The platform was developed by taking into account the results of the need assessment that was carried out in the first year and this year. This web-based platform has several features or user experience, as follows:

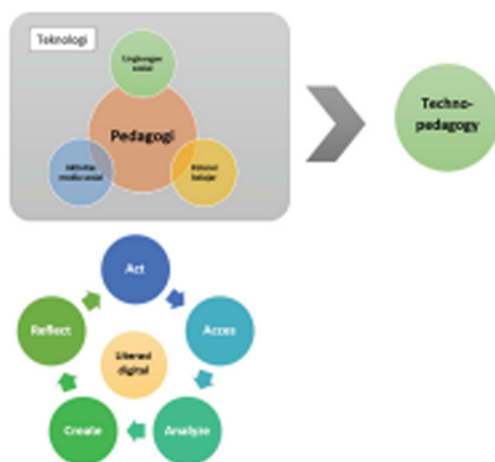
Assessment for the score of critical thinking skills was tested on 106 students as respondents. Critical thinking ability scores obtained in this study have fulfilled the requirements of the Normality test using Kolmogorof-Smirnov carried out by utilizing SPSS software with the following analysis results:

1. Feature no skip.

This feature is presented so that students can listen to the learning video until it is finished without being accelerated or missed (Fig. 3).

2. Feature interactive video

Through this feature, the lecturer can bring up a quiz popup in the middle for a certain duration. This feature aims to invite students to focus on listening to learning



**Fig. 2.** Design of technopedagogy-based education model for digital literacy



Fig. 3. Feature No Skip

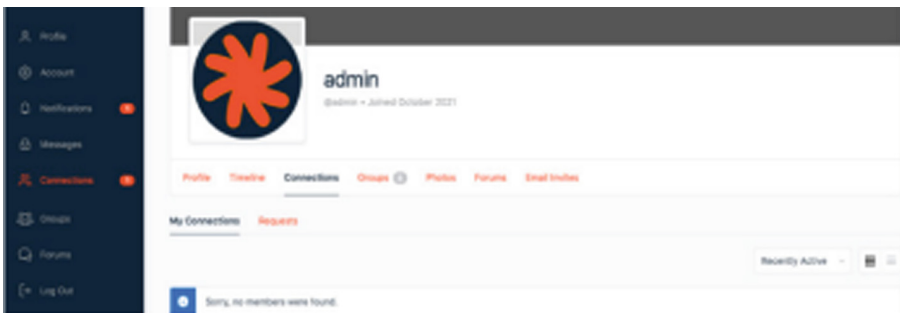


Fig. 4. Feature Interaction Video

videos, because if students cannot answer questions, the video will automatically return to the duration of delivery related to the quiz (Fig. 4).

### 3. Feature social interactive

This feature allows students to interact with each other in the LMS, either discussing in groups or talking privately between students.

## 3.2 Quality of Technopedagogy-Based Education Model

The effectiveness of the techno-pedagogy-based education model consists of aspects of ease of use of the device and the usefulness of opinions according to student perceptions. Each of these aspects is presented in the following figure:

Based on Fig. 5 shows most of the students admitted to agree that using Techno pedagogy tools in learning is easy. This is indicated by the presence of 48 students who think they agree, 28 students think they strongly agree, and 1 person disagrees out of 77 students (Fig. 7).



Fig. 5. Feature Social Interactive

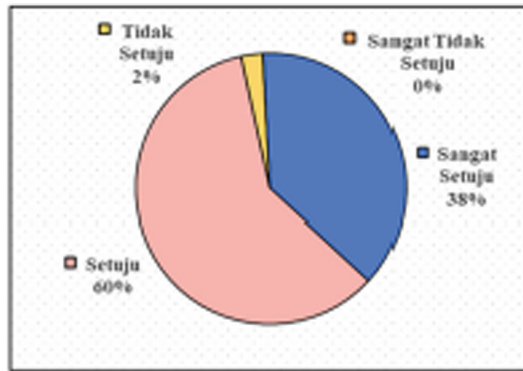


Fig. 6. Ease of use of the device

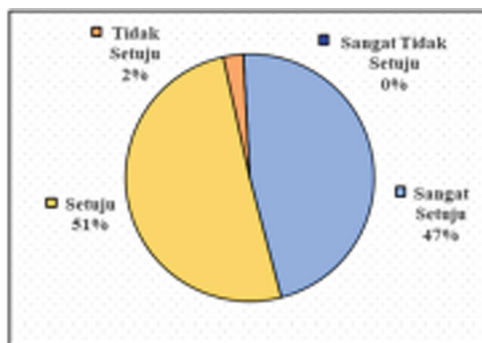


Fig. 7. Device Benefit

Based on Fig. 6, it shows that the opinions are relatively close between agree and strongly agree about the usefulness of the Techno-pedagogy model. This is indicated by

36 students who strongly agree and 40 students who think agree about the usefulness of the Techno-pedagogy model in learning. in this case there is only 1 person who does not agree and there are no students who answer strongly disagree.

Based on these two indicators, it shows that students agree that the Techno-pedagogy model is effectively used in learning. This shows that the Techno-pedagogy model can improve the quality of the learning process.

**3.3 Improved Digital Literacy of Student with Technopedagogy Model**

The increase in students’ digital literacy using the techno-pedagody model was measured using pretest and posttest instruments. The pretest and posttest were carried out by 94 students. The results of the pretest and posttest were analyzed using the t-test to determine the increase in students’ digital literacy. Before being analyzed using the t test, there is a requirement for pretest and posttest data which is called the assumption test.

1. Result of assumption parametric

The assumption test for the t-test analysis is the normality and homogeneity test. The results of the normality test are presented in Table 7 and the homogeneity in Table 8. The normality test aims to determine whether the students’ abilities are normally distributed or not. The following are the results of testing the normality of the pretest and posttest of students’ digital literacy skills.

Based on Table 2, it was found that the significance value of the student pretest was  $0.102 > 0.005$  and the student post-test was  $0.200 > 0.05$ . This shows that the pretest and posttest results of students’ digital literacy skills are normally distributed. Homogeneity testing aims to determine whether the student’s ability has a homogeneous variance or not. The following are the results of testing the homogeneity of students’ digital literacy abilities.

Based on Table 3, the significance value of students’ abilities is  $0.083 > 0.05$ . This shows that students’ digital literacy skills have a homogeneous variance.

2. Result of mean different test

After the data is normally distributed and has a homogeneous variance, the analysis to determine the increase in students’ digital literacy skills has the following results:

**Table 2.** Test of Normality

	Statistic	df	Sig.
Data pretest	0,084	94	0,102
Data posttest	0,069	94	0,200

**Table 3.** Test of Homogeneity

Levence	df1	df2	Sig.2
3,044	1	186	0,083



**Table 4.** CORRELATION OF PRETEST AND POSTTEST

	N	Correlation	Sig.
Correlation pretest & posttest	94	0,517	0,000

Mean			
Mean S t d .	Dev.	t-tes	df Sig. (2-
S t d . Error		tailed)	
	-8,011	3,630	0,374 -21,400 93
Pair pretest & posttest		0,000	

**Fig. 8.** PAIRED SAMPLE TEST

Based on Table 4, a significant value of  $0.000 < 0.05$  was generated. This shows that there is a relationship between the pretest variable and the pretest variable. Improving digital literacy skills can be seen in Table 10.

Based on Fig. 8, the significance value (2-tailed) is  $0.000 < 0.005$ . This shows that there is an increase in students' digital literacy skills with a techno-pedagogy-based education model.

Techno-pedagogy according to Herlambang [16] dan Yuniarti et al. [17] is said to be an art of combining technology in designing teaching and learning experiences to improve student competence in various aspects of cognitive, affective and psychomotor. In short, digital pedagogy is an attempt to use technology to transform teaching and learning in various ways [18]. Techno-pedagogy is an effort in the technological literacy movement which is one of the demands of the 21st century. The implementation of techno-pedagogy as one of the learning concepts in the digital era is based on the different characteristics of each generation in life. Today, life is dominated by the millennial generation (generation Y) and generation Z, who are even commonly referred to as digital natives (the generation that makes digitalization a part of their daily life and culture). Therefore, education today must be able to utilize the capital of mastering technology tools for generation Y & Z students, as well as directing them to be able to have digital literacy that is able to increase critical, positive, and wise attitudes so that they are able to become human beings who have a complete personality.

Undoubtedly, knowing how to use technological tools is important [19] because it has the potential to increase digital literacy. However, having digital literacy skills is not enough if only the ability to operate technological tools is enough. Digital literacy skills include the individual's ability to sort, select, understand information and communicate which is something that every individual needs [20]. Through education, human resources are expected to create a generation that cannot be replaced by computers, think critically, imaginatively, inventively, solve problems, interact better, and work together with people who will make them excel in the real world work environment [21, 35]. These abilities can be achieved if this generation has skills such as digital literacy [20, 21]. Digital literacy, which is a complex set of skills related to digital technology, can be analyzed from various aspects as an effort to bring up digital literacy skills to students

through the implementation of the techno-pedagogy model. The analysis in question can be seen from social environmental factors, social media activities and student learning potential.

Herlambang [16] suggests that the implementation of techno-pedagogy in learning must pay attention to several things, including the ability of students about technology (as a learning potential), as well as sociocultural background. In addition, Fox [22] said that socio-anthropic environmental conditions can also affect students' digital literacy skills. Based on the opinion of Herlambang and Fox, it can be understood that the implementation of techno-pedagogy to improve students' digital literacy can be influenced by the social environment in which students are located. The influence of the social environment in question includes family circumstances or interactions with teachers and friends [23–26]. The characteristics of techno-pedagogy that require technological devices in their implementation encourage students to be able to have learning support devices such as smartphones, computers and laptops. Therefore, the condition of the student's family greatly influences the results of implementing techno-pedagogy to increase their digital literacy. For students who receive support for learning support facilities and infrastructure with techno-pedagogy, it will be easier for them to improve their digital literacy, while for students who lack family support or are in remote areas, it will be difficult for them to participate in learning even though they have mobile devices. or laptops to study due to internet limitations they experience [27, 28].

In conducting learning with technology, Prakash [18] revealed that there are three components that must be observed, namely: 1) content, which includes the subject matter to be taught, 2) technology, which includes the use of technological tools in learning, and 3) pedagogy, which describes the processes, strategies, procedures, and teaching and learning methods used, also includes knowledge of the objectives of teaching, assessment, and student learning. This means that the use of electronic elements in teaching by teachers does not mean they have practiced techno-pedagogy [18, 29]. The implementation of technopedagogy must be based on the three concepts above. The integration of technology in learning should also be based on well-thought-out content, nor should it be used on the basis that students feel that 'without technology the classroom will be boring [29]. Moreover, the techno-pedagogy model is expected to improve students' digital literacy skills which consist of access (access), analyze (analyze), create (create), reflect (reflection), and act (action) competencies as found in the research. This to bring out all these competencies through techno-pedagogy, increasing the number and variety of quality learning resources is the main thing that needs to be prepared to support the development of digital literacy, for example by providing educational sites as learning resources [20, 34] such as developing content uploaded on the internet. And LMS conducted in this study.

The provision of this educational learning site can be related to student social media activities, because if the available learning sites are directed at the form of digital content, then student social media activities can be more controlled and focused on the learning content provided. Pavlik [30] dan Conole et al. [31] said that the use of social media for learning can support student learning activities as well as provide new experiences that challenge traditional learning assumptions. This means that the development of techno-pedagogy-based learning content can have good implications for digital literacy.

In addition, it has been previously mentioned that mastery of digital literacy is not determined by how often students interact with digital technology or social media, but is related to how their attitudes and interests are in using digital technology and these communication tools effectively [32, 33]. Therefore, controlling digital content based on techno-pedagogy to be seen by students in learning can be an intervention to strengthen students' digital literacy.

The results of this study are in line with previous research which found that blended learning can improve students' critical thinking skills and transform students' knowledge [9]. Students in Indonesia are used to the face-to-face learning process, where the teacher explains learning to students in class. So that full online learning in general is still not appropriate for students in Indonesia.

For further research it is suggested to examine critical thinking from the point of view of socio-cultural factors. Stapleton [22] found that Asian students may not reflect the concept of critical thinking because Western-oriented critical thinking may differ from Eastern educational cultures.

## 4 Conclusion

The results of this study indicate that the technology-based education model can improve students' digital literacy skills. The technology-based education model developed is in the form of an educational learning platform for web-based students with several user experience features, such as no skip features, interactive video and social interaction. These features were developed as an intervention to control student social media activities, and were developed by taking into account the learning potential and background of the student's social environment.

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