Digital literacy of indonesian prospective physics teacher: Challenges beyond the pandemic

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Abstract. Pandemic covid-19 reinforces the needs of digital technology in all aspects, including education. Digital literacy skills become essential for all teachers and also prospective teachers. This study aims to find an overview of the digital literacy capabilities of prospective physics teachers. This study was a quantitative descriptive research with data collection using an instrument in a questionnaire that included 29 items from 4 aspects of digital literacy: Accessing content, creating content, transliteracy, and evaluating content. The sample consisted of 171 physics education students from 3 State Universities in Indonesia. The result showed the level of digital literacy in the moderate category. From the four aspects, creating content related to creating or presenting information on various digital platforms showed lower results than accessing content, transliteracy, and evaluating content. In a prospective science teacher curriculum, creating learning content on digital platforms needs to be developed. This research finding suggests that digital literacy needs to be enhanced during the prospective science teachers' program.

1. Introduction

Digital literacy is a life skill that involves using technology, information and communications, social skills, learning ability and attitude, critical thinking, creativity, and inspiration as digital competencies[1]. Literacy culture is a prerequisite for life skills in the 21st century that must be developed through integrated education starting from family, school, and community[2]. In the last few years, information and communication technology development in all education sectors has been notable [3]. Active and contextual learning will be carried out optimally if supported by adequate media, methods, tools, and materials. In the era of this technology development, various forms of media are proliferating. Through virtual learning or online learning, the learning process is not limited by time and space. The interaction between teachers and students takes place anytime and anywhere. Online learning is a distinct advantage for teachers and students that make students more active in constructing knowledge[4].

Meanwhile, as the effect of the COVID-19 pandemic, science teacher educators were faced with deciding how to support prospective teachers learning to teach [5]. To further complicate this rapid transition, educators' autonomy was constrained by a range of institutional, technological, accreditation, and regulatory issues. For many, this means planning for online science teaching methods courses, working closely with accrediting bodies and university clinical placement offices to explore alternatives to face-to-face experiences, and negotiating variances of in-person and online student teaching experiences[6]. In connection with the Covid-19 pandemic in Indonesia, the government has provided

regulations regarding distance learning in which prospective teachers and teachers must master technology to support learning. The 21st-century skills are needed as digital literacy is used as a tool for working[7]. This National Literacy Movement was carried out to develop a digital literacy culture. Based on a survey conducted by the Ministry of Information and Information in collaboration with UNICEF on children and adolescents aged 10-19 (as many as 400 respondents) spread throughout Indonesia and representing urban and rural areas, information was obtained that around 79.5% of children and adolescents are internet users and digital media. It has resulted in a transition where school-age children and adolescents like to explore information through the internet and digital media, like exciting lessons that can be used immediately with various available applications, and tend to like the virtual world[2].

Digital literacy in the preparation of prospective teachers is becoming a new concern around the globe. In Israel, the circumstances of the prospective teacher showed that most of the participants had basic research and information search skills overall[8]. Moreover, in Indonesia, this study indicated that not all informants had digital literacy skills because this skill requires continuous and consistent practice to do it well[1]. The teachers perceived that they were ready to manage digital learning due to school closures amidst the pandemic[5]. Therefore, a choice of technology and teaching methodology to adapt and adjust was a solution to the learning problems[9]. On another level, self-perceptions and skills of prospective physics teachers in the Technological Pedagogical and Content Knowledge Knowledge (TPACK) framework to support distance learning. Based on data analysis, self-perceptions of prospective physics teachers within the TPACK framework are insufficient category. There is a significant difference between the self-perception of prospective physics teachers who have taken computer training and those who have never taken computer training. The skills of prospective physics teachers in the TPACK framework are also sufficient [10]. However, the specific measurement of prospective physics teachers' digital literacy in Indonesia is rarely found. Therefore, our research aims to explore the digital literacy level and the aspects of Indonesian prospective physics teachers.

2. Method

2.1 Instrument Preparation

The questionnaires generated our primary data, and then it was made on a measuring scale to produce quantitative data. This research was quantitative descriptive research with an instrument in a questionnaire that included 29 items from 4 aspects of digital literacy. Research subjects were asked to fill out a questionnaire about their basic competencies of digital literacy prospective physics teacher and focus on four contents, as shown in figure 1.

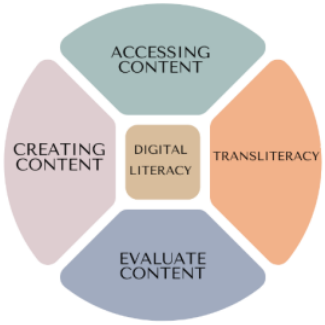

Figure 1. The Aspect of Digital Literacy

In this study, the scale used was the Likert scale. For quantitative data analysis, the answers of the respondents were given a score from 1 to 5. Then, the questionnaire was tested for its validity and reliability. Validity and reliability tests were carried out using the application of *SPSS Statistics 20*. From the test results, 25 questions were valid, and four were revised with provisions for correcting sentence editors. Reliability results were also in the high category[11].

In preparing a questionnaire on digital literacy, a theoretical study from experts is required and analyzed to understand digital literacy. Then, basic competencies are adapted to conditions in the field.

A trial was conducted to measure its validity and reliability. The test was given to 25 Physics education students class of 2018. The calculations used the help of SPSS Statistic 20 for the Windows application. In this calculation, the numbers obtained must be compared with the critical values for the Pearson correlation[11]. In testing reliability, the coefficient value must be at least more than 0.70 for the questionnaire to be ready to use.

2.2 Data Collection

The data collection was conducted by using purposive sampling. The chosen sample which met the requirements amounted to 171 prospective physics teachers from 3 universities. Sample A was located in East Kalimantan, sample B in South Kalimantan, and sample C in Sumatra island. The sampling technique used was purposive sampling, a deliberate choice of research participants because of the quality with specific criteria [12]. The criteria were three study programs that have used curricula by emphasizing the principles of developing science-based physics learning media, contextual technology, especially Information and Communication Technology (ICT).

2.3 Data Analysis

2.3.1 Instrument Response Analysis

Primary data was generated from distributing questionnaires, then made on a measuring scale to produce quantitative data. In this study, the scale used was the Likert scale. For quantitative data analysis, the answers of the respondents were given a score from 1 to 5.

2.3.2 Digital Literacy Level of Students

The results of the research data score were then processed and made on a scale of 100 with the formula:

$$A = \frac{X}{Y} \times 100 \qquad (1)$$

A = final score with a scale of 100
X = score obtained by each respondent
Y = Maximum score of 29 questions

Using the Norms Reference Assessment system, the digital literacy level was categorized into very high, high, medium, low, and very low ability levels [13]. Norms Reference Assessment is an assessment that refers to the group norms or the values obtained by students compared to the values of other students in the group. The requirements in determining the category using the Norms Reference Assessment technique are shown in table 1.

Tabel 1. Category of Digital Literacy[13]

Category	*Interval*
Very High	$x \geq \bar{x} + 1.5$ SD
High	$\bar{x} + 0.5$ SD $\leq x < \bar{x} + 1.5$ SD
Moderate	$\bar{x} - 0.5$ SD $\leq x < \bar{x} + 0.5$ SD
Low	$\bar{x} - 1.5$ SD $\leq x < \bar{x} + 0.05$ SD
Very Low	$x < \bar{x} - 1.5$ SD

2.3.3 Aspect of Students Digital Literacy

The results of the research data were then processed based on each aspect. The percentage was obtained with the formula:

$$Z = \frac{X}{Y} \times 100\ \% \qquad (2)$$

Z = Percentage score
X = score obtained for each aspect
Y = Maximum score from all aspects

A test was carried out using Pearson product moment with the help of the *SPSS* application to find out the correlation between each asset. After obtaining the results, the data were then analyzed to get a conclusion.

2.3.4 Correlations of Aspect Digital Literacy

In correlational research, researchers seek to determine whether a relationship exists between two (or more) quantitative variables, such as age and weight or reading and writing ability. In this study, correlation test using SPSS 20 for windows application.

3. Result and Discussion

In this study, the results from data collected through the questionnaires were examined. From 171 responses, the analysis clarified the level of digital literacy and the aspects: accessing content, creating content, transliteracy, and evaluating content. Moreover, the correlation of each aspect was also explored.

3.1 Digital Literacy Level

The results of the research data score were then processed, and the average scores were analyzed using Microsoft Excel. The results of students' digital literacy questionnaire responses can be seen in the table of scores. The average score was 73, and the Standard Deviation was 8.84, so the value was in the medium category[13]. The data interpretation of students' digital literacy levels is presented in the following table 2.

Tabel 2. Levels of Digital Literacy Skills. In general, the level of digital literacy skills is in the medium category

Category	*Frequency*	*%*
Very High	12	**8.22**
High	28	**19.18**
Moderate	63	**43.15**
Low	33	**22.60**
Very Low	10	**6.85**
Total	**146**	**100**

The majority of students were already in the high category at using technology and finding sources of information effectively. However, evaluating an information source and creating work in learning still has to be improved. In the field, students rarely create new and reliable sources of information. The students demonstrated medium to low digital literacy readiness. These results pointed out that prospective teachers with current technological sophistication lack the knowledge, skills, and necessary experience to integrate technology into the classroom to assisting them in teaching and assisting their students in learning. In addition, some students lack basic technology skills, and therefore they need more hands-on practice in the operation of basic technology.

3.2 Aspect of Digital Literacy

The results of data interpretation regarding aspects of digital literacy can be seen in Figure 2.

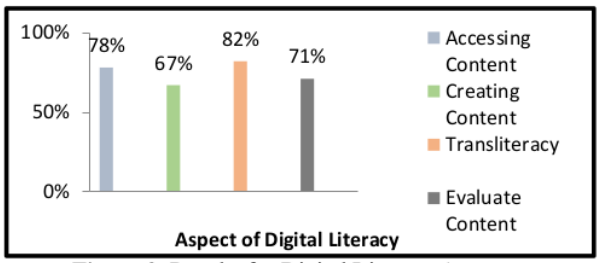

Figure 2. Results for Digital Literacy Aspects.

From the results, the aspect of transliteracy had a more significant percentage, which was 82%, then accessing content was 78%, and evaluating content was 71%. The lowest was the aspect of creating content which was 67%. Then, viewed from the indicators of each aspect, it can be presented in figure 3.

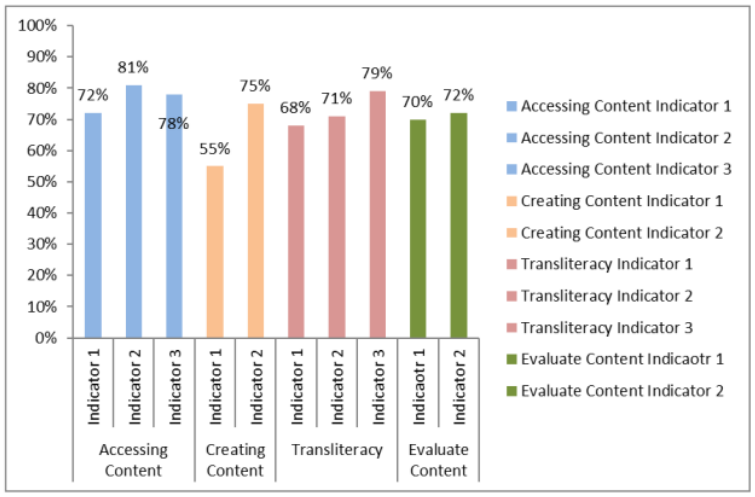

Figure 3. Percentage of indicators for each aspect

Based on the figure above, it can be seen that the abysmal ability is in the aspect of creating content indicator 1. While the highest ability that many students have is in the aspect of accessing content indicator 2.

3.2.1 Accessing Content

Indicators of these aspects are recognized as information needs, access, understanding, and use of information effectively and efficiently, select and sort methods to access the required information and identify the types of information sources in the digital library[8][14]. Referring to how the student can access or find a reliable source of information, most students can select and sort methods to access the information needed and identify the types of sources of information obtained. Meanwhile, the ability to recognize information needs, access, understanding, and use of information effectively and efficiently is still relatively low compared to the other two indicators. Overall, these results indicate that selecting information effectively and efficiently still needs to be improved.

3.2.2 Creating Content

Indicators of these aspects are to create web pages by inserting images, text, and hyperlinks to convey information and to use ICT to create or design information[8][14][15]. This aspect includes questions about student skills in creating or presenting information on various platforms and using various platforms of e-learning. This aspect and indicators can create new sources of information using existing technology. The aspect of creating content can be developed through subjects in the study program. Among them, in one of the Universities on physics education study program, there is a course "Physics Workshop" which aims to facilitate students in doing physics practicum. This lecture teaches about applying physics concepts in everyday activities and designing them into simple technological products. However, this course is an optional course and not required for students.

Meanwhile, there are no similar courses in the other two study programs that can produce products related to physics. However, several replacement courses can develop the aspects of creating content, such as laboratory research subjects and technology and information applications. This aspect needs to

be improved for prospective teachers, in line with the increasing technology and information that continues to develop.

3.2.3 transliteracy

Indicators of this aspect may use various learning applications (Quiziz, google classroom, Edmodo, Phet, and others), be able to store information and mark by entering copyright, and understand the ethical implications or consequences of literacy users[16][8][14][15]. It involves the ability to take advantage of all different platforms, especially to create content, collect, share and communicate through various social media, discussion groups, smartphones, and various available online services.

In addition, most students rarely use supporting applications as learning media. For example, the zoom meeting application is still rarely used by students. Some of the reasons are that the teaching place's network is less supportive; some feel less comfortable using face-to-face applications, and it is easier to use group chat. Another example is the virtual lab, in which various virtual lab resources are still unfamiliar to prospective teacher students. This knowledge is reasonably necessary. According to the current situation that makes it impossible to use the usual laboratory, using a virtual lab is beneficial for students' understanding.

3.2.4 Evaluate Content

Indicators of this aspect compare information from various sources and critically evaluate information sources (such as quality, reliability, credibility, and efficiency in use)[16][8][14][15]. It contains the ability to sort the information to be presented and its relationship with classroom learning. Based on the results of the response, students are pretty selective in evaluating the information obtained. However, students also pay less attention to the credibility of the information obtained. It can be seen from the lack of concern for students to improve an inaccurate source of information. Evaluate content needs to be developed to improve valid and reliable information.

3.3 Correlation Levels of Digital Literacy Aspects

The relationship between aspects of digital literacy in this study was carried out by correlation analysis using bivariate with the Pearson correlation test to determine the significance between aspects. Based on the data analysis results, the correlation values shown range from 0.41 to 0.60. These results indicate that a reasonably good relationship exists between aspects. Therefore, the aspects are related to each other.

4. Conclusion

Based on the results of research carried out regarding the ability level of digital literacy aspects of prospective physics teacher students, it can be concluded that the level of digital literacy skills is in the medium category, with an average score of 73%. Students' digital literacy skills are supported by courses related to digital literacy, such as physics learning courses.

The contribution from each aspect of digital literacy dramatically affects the level of digital literacy of students. It can be seen from the results of data analysis that the aspects of creating content still need to be developed to be able to improve students' digital literacy skills. Each aspect of digital literacy and the level of correlation for each aspect shows a mutually constructive relationship between aspects; the higher the contribution of each aspect, the more excellent the digital literacy skills of prospective physics teacher students. This conclusion is supported by the acquisition of calculations that show a sufficient correlation value between aspects of digital literacy.

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