Digital literacy of preservice science teacher

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Abstract. The development of digital technology takes place very quickly and gives significant influences in various areas of life including education. The Standards of Academic Qualification and Teacher Competence has integrated the digital literacy on the competences of professional teachers. College has a big hand in equipping teachers with various competencies so that teachers are ready in carrying out their duties as educators. This study aims to identify the digital literacy of preservice science teacher who have attended science lectures. By using the Likert scaled questionnaire and guided interview, the researcher tries to explore five areas of digital literacy consisting of information, communication, content creation, safety, and problem solving. The results of this study indicate the digital literacy of preservice science teacher are in the medium category with the composition; information (2.97), communication (2.95), content creation (2.64), safety (2.63), and problem solving (2.12). It takes program that can stimulate the improvement digital literacy of preservice science teacher in order to able to innovate science learning activities using technology.

1. Introduction

The development of information and communication technology is happening very rapidly. These developments have a significant impact on people's lifestyles and needs in various fields. It will form a community model that requires the skills and competencies to take maximally benefits from the potential of the latest technologies and to take part or participation of the community in the economic, social, and culture [1].

Technology that develop very rapidly is a digital technology which begins with the invention of computers and the internet [2]. Developments in digital technology can be utilized in the education field, especially in the implementation of teaching and learning activities in order to achieve successfully educational goals. The European Commission has set European priorities in 2020 by developing media and digital literacy. The people are demanded to have ability in learning, creating, engaging, and making differences on use of digital media as an effort in preparing human resources to face the global challenge [3].

It cannot be ignored by indonesian people who are facing global and open market. It means the competence of Indonesian human resources must be high competitiveness. This challenge also applies to teachers who have important duty in preparing the future human resources. Teachers must possess a number of competencies to become professional teachers. They are able to utilize information and
By the digital technology which is developing continuously, teachers can provide a number of benefits and new meanings in learning activities [5]. In practice, teachers need a number of technology utilization skills in educational activities, one of which is formed by digital literacy. Digital literacy is a number of capabilities to understand and use information in various formats sourced from various sources presented in computer media [6].

Basically, the definition of digital literacy has been developed long enough. Giltser [7] revealed that digital literacy is the ability to understand, value, and use information in the various formats presented in the computer. Some experts have also provided mutually supportive opinions by defining digital literacy as basic skills in using information and digital tools to develop strategies for using them critically as an attempt to solve real-life problems [8-10]. Digital literacy is continuous with progressive steps.

Ferrari [11] defined digital literacy as the number of competencies and skills required for internet literacy, ICT literacy, information literacy, and media literacy involving the knowledge, attitudes and skills required to identify, locate, access, retrieve, store and organize information. The main focus of digital literacy is problem solving, building knowledge through technology and media critically, creatively, flexibly, and ethically. Ferrari [12] also argued that digital literacy is composed of five aspects of competence namely information, communication, content creation, safety, and problem solving.

To identify digital literacy preservice science teacher, then developed a number of indicators for each aspect. Indicators of each aspect of digital literacy are shown in Table 1.

Table 1. Indicators for each digital literacy aspect.

| No | Competence area | Indicator |
|----|-----------------|-----------|
| 1  | Information     | 1.a Finding information about goods and services |
|    |                 | 1.b Obtaining information from public authority websites |
|    |                 | 1.c Reading or downloading online news/newspapers/news magazines |
|    |                 | 1.d Evaluating information |
|    |                 | 1.e Storing dan retrieving information |
| 2  | Communication   | 2.a Sending/receiving emails |
|    |                 | 2.b Telephoning over the internet/video calls (webcam) over the internet |
|    |                 | 2.c Participating in social networks |
|    |                 | 2.d Posting messages to chat sites |
|    |                 | 2.e Uploading self-created content to any website to be shared |
| 3  | Content creation| 3.a Creating websites or blogs |
|    |                 | 3.b Writing a computer programme using a specialised programming language |
|    |                 | 3.c Using copy and paste tools to duplicate information within a document |
|    |                 | 3.d Creating electronic presentations with presentation software |
|    |                 | 3.e Using basic arithmetic formulae to add, subtract, multiply or divide figures in a spread sheet |
| 4  | Safety          | 4.a Using any kind of IT security software or tool (anti-virus, anti-spam, firewall etc.) in order to protect private computer and data |
|    |                 | 4.b Updating one or more security products at least occasionally |
| 5  | Problem solving | 5.a Connecting and installing new devices |
|    |                 | 5.b Installing a new or replacing an old operating system |
|    |                 | 5.c Modifying the configuration parameters of software applications |
|    |                 | 5.d Solving technical problems |
|    |                 | 5.e Doing an online course |
2. Method
This research was a descriptive study to get the description of preservice science teacher digital literacy in elementary school teacher education department in one of college in Sumedang. The respondents that involved in this study were 67 students taked learning science in odd semester 2017/2018. They consist of 27 males and 40 females.

Instruments used in this study are two types. They are questionnaire and guided interview. Questionnaire is used to determine sample responses in research based on their digital capabilities. The questionnaire used includes five main parts of the digital literacy aspects, they are information, communication, content creation, safety, and problem solving. The questionnaire consist of 24 questions with the composition: information are 5 questions, communication are 6 questions, content creation are 5 questions, safety are 2 questions, and problem solving are 6 questions. Each question is accompanied by a response using a Likert scale with the criterion: very low (1), Low (2), Moderate (3), high (4), and very high (5) [13]. Assessment results from the mean of Likert questionnaire will be classified into five categories as shown in Table 2.

Table 2. Classification of digital literacy questionnaire.

| No | Mean       | Category   |
|----|------------|------------|
| 1  | 0.0 ≤ x ≤ 1.4 | Very low   |
| 2  | 1.5 ≤ x ≤ 2.4 | Low        |
| 3  | 2.5 ≤ x ≤ 3.4 | Moderate   |
| 4  | 3.5 ≤ x ≤ 4.4 | High       |
| 5  | 4.5 ≤ x ≤ 5.0 | Very high  |

The second instrument is a guided interview. This guided interview is used to analyze the activities of the science lecture that students have followed. By the interview, the author expects to obtain information that can provide explanations related to preservice science teacher digital literacy. The guided interview consist of six main questions about the methods used in the lectures, the mechanism of assignment, media, the involvement of students in the ICT utilization, facilities used in submitting assignment and the availability of consultation time. In its implementation, six main questions were developed according to the answers raised by the respondents.

3. Result and discussion
Digital literacy observed in this research includes five aspects of digital literacy. They are information, communication, content creation, safety, and problem solving. The digital literacy of preservice science teacher who have attended the science lecture is shown in Figure 1.
Generally, digital literacy of preservice science teacher is still not showing the expected competence. This is similar to another research that digital literacy of preservice science teacher is still not skilled enough because they are unfamiliar in using technology [14]. There are four aspects of digital literacy (information, communication, content creation, and safety) which are in moderate category with means are in the range 2.4 until 3.4. The other aspect, problem solving, is in low category with range 1.4 until 2.4.

Interview with some representative respondents obtained information that preservice science teacher usually use online communication with each other. Online communication activities were also conducted to discuss the lecture assignments. In carrying out the assignments, students should find out the needed information which then should be mixed into an original work as a form of creativity by using some frequently used applications such as word and power point. Thus learning activities are enough to facilitate the ability of digital literacy, especially on four aspects of digital literacy (information, communication, content creation and safety).

Each aspect of digital literacy has a number of different indicators as shown in Table 2. Mean of each indicator on five digital literacy aspects for preservice science teacher can be seen in Table 3.

| No | Aspect         | Indicator | Mean   | Category     |
|----|----------------|-----------|--------|--------------|
| 1  | Information    | 1.a       | 3.18   | Moderate     |
|    |                | 1.b       | 3.04   | Moderate     |
|    |                | 1.c       | 2.69   | Moderate     |
|    |                | 1.d       | 2.72   | Moderate     |
|    |                | 1.e       | 3.22   | Moderate     |
|    |                | 2.a       | 3.42   | Moderate     |
|    |                | 2.b       | 3.19   | Moderate     |
|    |                | 2.c       | 3.09   | Moderate     |
|    |                | 2.d       | 2.61   | Moderate     |
|    |                | 2.e       | 2.46   | Low          |
| 2  | Communication  | 3.a       | 1.73   | Low          |
|    |                | 3.b       | 1.24   | Very low     |
|    |                | 3.c       | 3.76   | High         |
|    |                | 3.d       | 3.51   | High         |
|    |                | 3.e       | 2.96   | Moderate     |
| 3  | Content creation | 4.a    | 2.57   | Moderate     |
|    |                | 4.b       | 2.69   | Moderate     |
|    |                | 5.a       | 1.82   | Low          |
|    |                | 5.b       | 2.27   | Low          |
| 4  | Safety         | 5.c       | 2.79   | Moderate     |
|    |                | 5.d       | 2.28   | Low          |
|    |                | 5.e       | 1.43   | Low          |

From Table 3 we can get information that among the five aspects of the digital literacy capability are only two aspects that each indicator is consistent in moderate category, they are information and safety. In the information aspect, although all mean show the same category, the value of mean are varied with the highest score on the indicator “Storing and retrieving information”. It is caused by the skills in this indicator is a basic skill that is often used when searching online information. In the safety aspect, all indicators show moderate category with the greatest mean on the indicator “updating one or more security products at least occasionally”. A number of security products have been accompanied by
settings where the system can remind the user to update product. So many of the respondents often update the security product regularly [15].

In the three aspects of digital literacy: communication, content creation, and problem solving, there is a distinct category in each indicator. In the communication aspect, they are generally on the enough category. But there is one indicator that is in the low category. It is “Uploading self-created content to any website to be shared” indicator. This is due to the lack of learning activities or lecture assignments that assign or facilitate students to perform activities to upload student creations on the website. In the problem solving aspect, most of the indicators are in the low category and only one is in moderate category. This condition is strongly influenced by the limitations of skill of preservice science teacher in using and repairing damaged digital tools and their fear of increasingly damaged digital tool if repaired by their selves.

One of the most diverse aspect is content creation. One indicator is in the very low category (writing a computer program using a specialised programming language), one indicator is in the low category (Creating websites or blogs), one indicator is in moderate category (using basic arithmetic formula to add, subtract, multiply or divide figures in a spread sheet), and two indicators are in the high category (using copy and paste tools to duplicate or move information within a document and creating electronic presentations with presentation software). In the lectures, students are often given a assignment in word format and then the assignment should be presented in front of the class. The students often use two main software to do their job so they have been skilled in making documents on word format and making presentation in power point (ppt) format. In the lectures, the preservice teacher never got assignment related to programming language. It certainly eliminates the motivation and enthusiasm of students to improve these competencies. Because it is not trained then it is very reasonable if the indicator of writing a computer program using a specialised programming language is very low.

4. Conclusion
Based on the result of research, we obtained a number of conclusions such that the digital literacy of preservice science teacher is still in the moderate category. Four categories, information, communication, content creation, and safety are in moderate category, while the problem solving aspect is still in the low category. The digital literacy of preservice science teacher is influenced by the number of activities and tasks in the science lecture.

The low of digital literacy is a challenge for college which facilitate preservice teacher. The college should prepare an effective program in order to train digital literacy for preservice teacher either through technology-based learning or special training activities to introduce and train five aspects of digital literacy. By these programs, the preservice science teacher are equipped to face the challenges of science learning which involves many technologies.

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