How Literate are Prospective Science Teachers in this digital era? Profile of Digital Literacy Skills of Preservice Science Teachers in South Sulawesi, Indonesia

by Sitti Saenab

How Literate are Prospective Science Teachers in this digital era? Profile of Digital Literacy Skills of Preservice Science Teachers in South Sulawesi, Indonesia

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Abstract – There is a lack of information about the digital literacy skill of prospective science teachers in Indonesia, specifically in South Sulawesi. The focus will be placed on their digital literacy skills in three dimensions: technical, cognitive, and social emotional. The population was undergraduate students from educational science program at three universities in South Sulawesi namely Universitas Negeri Makassar (State University of Makassar), Universitas Bosowa (Bosowa University), and IAIN Parepare (State Islamic Institute of Parepare). Sample consisted of 313 students. Results show that the average digital literacy skill is in the medium category.

Keywords – digital literacy, preservice science, teacher.

1. Introduction

Research around the globe has shown the data about digital literacy skill of world inhabitants. Based on the data released by the European Commission [5], EU average for the rate of basic digital literacy skill was 56%.

It was ranging from 86% in Luxembourg to 26% in Bulgaria. According to [11], the latest data from Eurostat shows that the average decrease to 54%. The highest percentage comes from the Netherland and Finland which is 79% and the lowest is 28% in Romania. Examples of digital literacy skills include obtaining material online, communication and collaboration skills, digital content creation skills, safety skills, and problem-solving skills. In the USA, data from the Pew Research Center revealed that majority (60%) of adults in America get an inadequate grade for digital literacy. Generally, younger adults and citizens with higher education managed to answer digital literacy questions correctly [4].

In Indonesia, [12] released the data about the 2021 Indonesia Digital Literacy Index, and it was at the "medium" level with a score of 3.49. Measurement with the 2021 Digital Literacy Index Framework uses four pillars, namely digital skills, digital ethics, digital safety, and digital culture. This index shows that male, at their young age, highly educated, living in urban areas tend to have a Digital Literacy Index above the national average.

According to [22], digital literacy education for young people is an important thing to do because young people are the most vulnerable people in consuming media. In addition, adolescent persons are expected to be agents of change to overcome various problems of digital society. Digital literacy training is needed so that individuals have a critical attitude in responding to any information and interactions that exist.

In the research of [21] that found a model of strengthening digital literacy which is the implementation of communication and collaboration elements consisting of three components of individual competence, namely use skills, critical understanding, and communicative abilities. Communication and collaboration are the elements of digital literacy in the form of active participation in learning activities carried out by utilizing e-learning.

The existence of this e-learning makes lecturers for basic courses required to master new media so that they can indirectly improve their individual digital literacy skills.

Digital literacy is the ability to understand and use information from various formats, in this case it focuses more on efforts to integrate the ability to find, evaluate, utilize, share, and create content using technology and the internet. Digital literacy is not only limited to mastering technology and the use of computers but more broadly in the sense of being able to combine "literacy" and "digital" [1]. Digital literacy has emerged along with the evolution of the internet and demands knowledge of how to access, search and critically analyze information. Furthermore, according to Ba and colleagues (2002) in [3] digital literacy is a set of habits in which young people use information technology to study, work and have fun.

Digital literacy is not a new term, but many people have found their understanding of digital literacy in recent years, namely on the one hand it can be said that digital literacy focuses on technical skills and on the other hand it means that digital literacy pays a lot of attention to understanding ideas [15]. Digital literacy refers to the ability to understand and use information in a variety of formats, highlighting the role of critical thinking versus simple understanding of ICT and Communication (ICT) skills. In short, digital literacy only emphasizes digital skills while others focus on multidimensional concepts [14]. Digital literacy is an important part of developing the learning process in universities in order to prepare students for the industrial revolution 4.0. Students with good digital literacy skills will try to find, select important information and be able to understand, communicate and convey ideas in the digital space [2].

According to Douglas Belshaw in [17] states that there are eight components of digital literacy, namely:

1. Cultural, namely understanding the various contexts of users of the digital world;
2. Cognitive, namely the power of thinking in assessing content;
3. Constructive, namely the creation of something that is expert and actual;
4. Communicative, namely understanding the performance of networks and communications in the digital world;
5. Responsible self-confidence;
6. Creative in doing new things in new ways;
7. Critical in addressing content;
8. Responsible rationally.

From [16] perspective, the achievement of digital literacy is based on four indicators, namely the intensity of the application and the use of digital literacy in learning activities, the amount and variety of reading materials and digital-based teaching aids, the frequency of borrowing digital-themed books and the number of activities in schools using digital media or websites. Gilster in [8] mentioned that there are four aspects of digital literacy competence that a person has to possess in order to be said to be digitally literate, namely:

1. Internet searching, namely the ability to use the internet, which includes the ability to use search engines to find information on the internet.
2. Hypertextual navigation, namely the skills to read and understand hypertext navigation in a web browser. Basically, reading a book by browsing via the internet is different from reading a textbook. Therefore, knowledge of hypertextual navigation is needed.
3. Content evaluation, namely the ability to think and assess what is found on the web and then identify the completeness of the information contained in hypertext links.
4. Knowledge assembly, namely the ability to collect information from various sources, then evaluate the facts and opinions of the information.

The dynamics of educational development today is a challenge for educators or teachers, where the main prerequisites that have to be possessed by teachers are four main competencies, namely pedagogic competence, professional competence, social competence, and personality competence. In addition, a teacher has to also have competence in mastering information technology and digital literacy, so that this becomes a necessity in order to utilize and integrate information technology in learning activities [6]. Digital literacy is important to master especially for prospective teachers because it can support in increasing self-confidence and competence in the use of technology in a way that will enable them to develop subject knowledge, encourage curiosity, support creativity, understand and enable them to make careful use of resources. available digital data [18].

For prospective teachers, of course, they have to have high digital literacy to optimally use information from digital sources that are very broad and can be accessed easily on the internet [19]. Furthermore, [7] said that prospective teachers who will become teachers in the future are required to be able to master digital literacy as an adaptation to digital trends and the needs of students in the digital era. As prospective educators in the future and with the development of digital technology, they are

expected to be able to master and apply digital literacy well in the implementation of learning activities to achieve educational goals [20].

Due to the lack of information about the digital literacy skill of prospective science teachers in Indonesia, specifically in South Sulawesi, it is essential to explore the profile of preservice science educators in South Sulawesi. Here, the focus will be placed on their digital literacy skills in three dimensions: technical, cognitive, and social emotional.

2. Methods

The research was descriptive research. The population was students in three universities in South Sulawesi that offer science education programs. The universities are Universitas Negeri Makassar (State University of Makassar), Universitas Bosowa (Bosowa University), and IAIN Parepare (State Islamic Institute of Parepare). Sample consisted of 313 undergraduate students of science education program.

Data collection was using the Indonesian version of digital literacy questionnaire developed by [13]. It consists of 15 statements that were categorized into three dimensions: technical, cognitive, and social emotional with 5 options: strongly disagree, disagree, neutral, agree, and strongly agree. The questionnaire was shared in the Google form. Data analysis was done by using a descriptive method. Students' score was calculated by converting the options into numbers from 5 to 1. Later, the average score of the students was categorized into very high to very low.

3. Results and Discussions

According to [9], digital literacy is "one's ability to understand, process, and process digital-based information". A similar definition is mentioned by [13], by whom digital literacy is the ability to understand and use information in various formats and sources. Progressively digital literacy is built on fundamental skills and knowledge. It requires awareness, attitude, and individual ability to use digital tools and facilities appropriately to identify, access, manage, integrate, evaluate, analyze, and synthesize digital resources, build new knowledge, create media expressions, and communicate with others in the context of certain life situations. Digital literacy skills to some set of skills are related to computers such as skills associated with working input and output devices, recognition of concepts and knowledge of how the digital environment, and the capability to interact effectively with digital evidence [10].

Result of digital literacy skills of undergraduate students in science education program can be seen in Table 1. Descriptive statistic was done for the maximum, minimum, and mean scores that has been gained by students from three universities in South Sulawesi.

Table 1. Descriptive result of digital literacy skill of preservice science teacher in South Sulawesi, Indonesia

	UNM	UNIBOS	IAIN	Total
Maximum	4,0	3,8	2,7	3,2
Minimum	1,0	2,0	2,3	2,3
Mean	2,8	2,5	2,5	2,8

As presented in Table 1, mean score for the digital literacy skills of preservice science teacher in South Sulawesi is 2,8 and categorize in average. This result is distinct compared to the result of [23] where they discovered that Turkish pre-service science teachers' digital literacy skills was qualified (mean score of each statement of the questionnaire vary from 3,17 to 3,98). Students from UNM and UNIBOS can reach maximum score in higher category compared to students who pursue their study in IAIN. On the other hand, students in UNM have the lowest score in the minimum aspect.

After being tested descriptively, the scores obtained by science education students in South Sulawesi were then grouped from the highest to the lowest. These results can be observed in Figure 1.
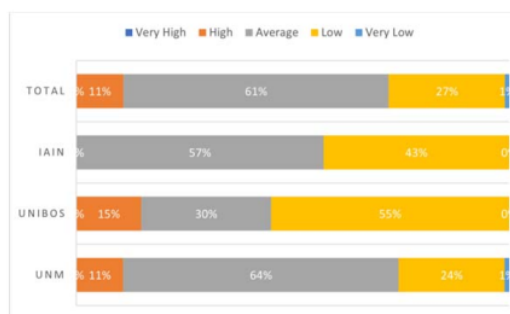

Figure 1. Categorization of digital literacy skill of preservice science teacher in South Sulawesi, Indonesia

Figure 1 shows the group distribution of digital literacy skills scores of students in total and from the three campuses in South Sulawesi. It can be observed that the majority of students have digital literacy skills in the medium category. Only the Universitas Bosowa has the largest category in the low group. In addition, there are no students who have skills in the high category.

Based on the scheme from [13] digital literacy skills consist of three dimensions, namely technical, cognitive, and socio emotional dimensions. The results of descriptive data analysis for the technical dimension can be observed in Table 2 and Figure 2.

Table 2. Descriptive result of technical dimension of digital literacy skill of preservice science teacher in South Sulawesi, Indonesia

Technical Dimension	UNM	UNIBOS	IAIN	Total
Maximum	4,0	3,8	2,7	4,0
Minimum	1,0	1,5	2,0	1,0
Mean	2,7	2,4	2,4	2,7

It can be seen in Table 2 that the average ability of students in the technical dimension has a score of 2.7, which means it is in the medium category, even for students at the Universitas Bosowa and IAIN Pare-Pare are in the low category. The maximum score of students at IAIN is in the medium category while at the other two campuses it is in the high category.
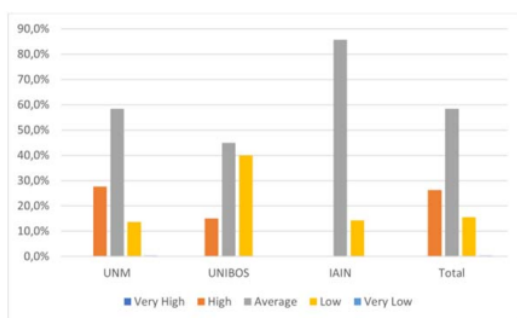
Figure 2. Categorization of technical dimension of digital literacy skill of preservice science teacher in South Sulawesi, Indonesia

Based on Figure 2, it can be observed that students at IAIN Pare-Pare are only in 2 categories where more than 80% in the medium category and the rest are in the low category. In general, students have skills in the technical dimension in the medium region and this pattern is also found at Universitas Negeri Makassar and Universitas Bosowa.

A digitally literate individual is able to operate adequate technology, for example through understanding file structure, managing, data transfer which includes understanding file size and space required for storage. That includes the following: finding, downloading and installing applications (and uninstalling them when not needed); use of infrared and/or Bluetooth for mobile devices; understand the data costs associated with downloading data; prepare and use communication tools and social networks; update/change user account information on the Internet; send and retrieve attachments via email and/or Dropbox; open it with the appropriate application such as unzipping a folder; knowing about the main features of a software program e.g. user interface elements - cues that define interactivity

(e.g. menus, sizes, dragging, scrolling, collapsible lists) and understanding tabs and their relationship to content.

The cognitive dimension is related to students' cognitive ability to think critically in handling digital information. This means that students are required not only to be able to find information but also to be able to process, reason, and understand the information that has been obtained. The results of the descriptive analysis of students' abilities in the cognitive dimension can be observed in Table 3.

Table 3. Descriptive result of cognitive dimension of digital literacy skill of preservice science teacher in South Sulawesi, Indonesia

Cognitive Dimension	UNM	UNIBOS	IAIN	Total
Maximum	4,0	3,5	3,0	4,0
Minimum	1,0	1,0	1,5	1,0
Mean	2,6	2,5	2,3	2,6

The information presented in Table 3 shows that the average score of students in the cognitive dimension is 2.6 or is in the medium category. This score is the same as the average student at Universitas Negeri Makassar, while at Universitas Bosowa and IAIN Parepare they are in the low category.
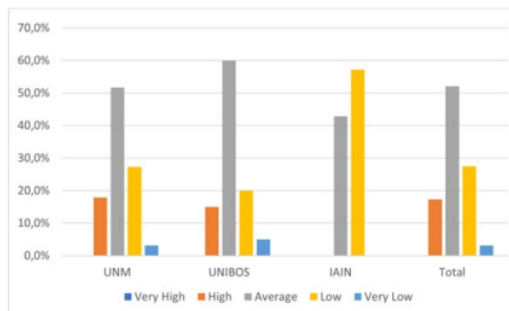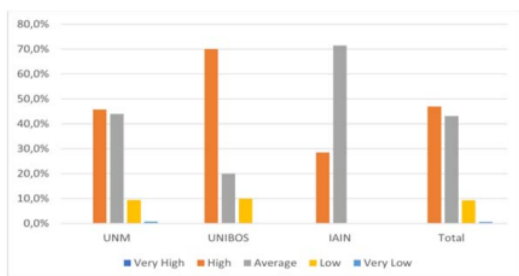

Figure 3. Categorization of cognitive dimension of digital literacy skill of preservice science teacher in South Sulawesi, Indonesia

The division of groups for the digital literacy skills of science education students in South Sulawesi for the cognitive dimension can be seen in Figure 3. In general, student's skills are divided into four categories from very low to high, except for the IAIN Parepare which is only divided into two categories, namely moderate and low. The highest category is moderate with the highest number of students at the Universitas Bosowa.

This cognitive dimension is able to evaluate and select the appropriate software program to study or perform a particular task. In addition, the cognitive dimension also requires individuals to have

knowledge of ethical, moral, and legal issues related to online commerce or the reproduction of content that is utilized as a digital-based resource [13].

The third dimension of digital literacy skills is the social emotional dimension. This area relates to a person's ability to use digital information to communicate and of course to use it responsibly. Student scores can be seen in Table 4.

Table 4. Descriptive result of social emotional dimension of digital literacy skill of preservice science teacher in South Sulawesi, Indonesia

Social Emotional Dimension	UNM	UNIBOS	IAIN	Total
Maximum	4,0	4,0	4,0	4,0
Minimum	1,0	2,0	2,5	1,0
Mean	3,2	3,4	3,1	3,2

The maximum score obtained by students is 4, which means it is in the high category while the minimum score is in the very low and low region for the three universities. The average student skills are in the medium range.

Figure 4. Categorization of social emotional dimension of digital literacy skill of preservice science teacher in South Sulawesi, Indonesia

The bar chart in Figure 4 shows information that in general, most students are in the high and medium categories for the social emotional dimension. Only a small percentage are in the low range. A striking difference in data can be observed at the Universitas Bosowa where more than 70% of the students are in the high category as opposed to the students at IAIN Parepare who are only in the medium category.

4. Conclusion

Generally, digital literacy skill of the preservice science teachers in South Sulawesi is in the medium category. Three dimensions of the digital literacy skill namely technical, cognitive, and social emotional are in the medium group ranging from 2,6 to 3,2. These results indicate that there is a potential to explore the area such as developing an instructional model, media, or learning resources to enhance preservice science teacher digital literacy skill.

References

[1]. Anggraeni, H. (2019). Penguatan blended learning berbasis literasi digital dalam menghadapi era revolusi industri 4.0. *Al-Idarah: Jurnal Kependidikan Islam*, *9*(2), 190-203.

[2]. Dinata, K. B. (2021). Analisis Kemampuan Literasi Digital Mahasiswa. *Edukasi: Jurnal Pendidikan*, *19*(1), 105-119.

[3]. Farias-Gaytan, S., Aguaded, I., & Ramirez-Montoya, M. S. (2022). Transformation and digital literacy: Systematic literature mapping. *Education and Information Technologies*, *27*(2), 1417-1437.

[4]. Feldman, S., & Richter, F. (2019, October 16). *Infographic: Americans get a failing grade for digital literacy*. Statista Infographics. Retrieved from: https://www.statista.com/chart/19677/digital-literacy-united-states/. [accessed: 10 September 2022].

[5]. Halachev, R. (2017). Nearly half of Europeans don't have basic digital skills - EPALE - european commission. EPALE. Retrieved from: https://epale.ec.europa.eu/en/content/nearly-half-europeans-dont-have-basic-digital-skills [accessed: 05 September 2022].

[6]. Kholid, K. (2020). Pentingnya Literasi Digital bagi Guru pada Lembaga Pendidikan Tingkat Dasar dan Implikasinya terhadap Penyelenggaraan Kegiatan Belajar Mengajar. *Jurnal Horizon Pedagogia*, *1*(1).

[7]. Kurniawati, J., & Baroroh, S. (2016). Literasi media digital mahasiswa universitas muhammadiyah bengkulu. *Jurnal Komunikator*, *8*(2), 51-66.

[8]. Kusumaningrum, H., & Hafida, S. H. N. (2021). Analisis Literasi Digital Terhadap Karakter Jujur Siswa Selama Pembelajaran Daring. *Pedagogia*, *19*(1), 24-35.

[9]. Kusumastuti, A., & Nuryani, A. (2020, March). Digital literacy levels in ASEAN (comparative study on ASEAN countries). In *IISS 2019: Proceedings of the 13th International Interdisciplinary Studies Seminar, IISS 2019, 30-31 October 2019, Malang, Indonesia* (p. 269). European Alliance for Innovation.

[10]. Mamedova, S., Pawlowski, E., & Hudson, L. (2018). A description of US adults who are not digitally literate. *US Department of Education*.

[11]. Masterson, V. (2022). *Which European countries have the most digital skills?* World Economic Forum. Retrieved from: https://www.weforum.org/agenda/2022/04/europe-basic-digital-skills/ [accessed: 17 September 2022].

[12]. Ministry of Communication and Information Technology (2021). *Status Literasi Digital di Indonesia 2021*. Katadata Insight Center.

[13]. Ng, W. (2012). Can we teach digital natives digital literacy?. *Computers & education*, *59*(3), 1065-1078.

[14]. Osterman, M. D. (2012). Digital literacy: Definition, theoretical framework, and competencies. In M. S. Plakhotnik, S. M. Nielsen, & D. M. Pane (Eds.), *Proceedings of the 11th Annual College of Education & GSN Research Conference* (pp. 135-141). Florida International University.

[15]. Peng, D., & Yu, Z. (2022). A Literature Review of Digital Literacy over Two Decades. *Education Research International*.

[16]. Pratama, W. A., Hartini, S., & Misbah, M. (2019). Analisis literasi digital siswa melalui penerapan e-learning berbasis schoology. *Jurnal Inovasi Dan Pembelajaran Fisika*, *6*(1), 9-13.

[17]. Rodin, R., & Nurrizqi, A. D. (2020). Tingkat Literasi Digital Mahasiswa Jurusan Ilmu Perpustakaan Dalam Pemanfaatan E-Resources UIN Raden Fatah Palembang. *Pustakaloka*, *12*(1), 72-89.

[18]. Sa'adah, S., Maryanti, S., Maspupah, M., & Mas' ud, A. (2020). Literasi digital mahasiswa calon guru biologi dalam menyusun bahan ajar berbasis audio visual. Retrieved from: https://etheses.uinsgd.ac.id/30681/ [accessed: 11 September 2022].

[19]. Sahrir, D. C. (2021). Analisis Literasi Digital Calon Guru Biologi pada Perkuliahan Bioteknologi di Masa Pandemi COVID-19. *Bio Educatio*, *6*(2), 13-20.

[20]. Sari, W. K., & Nada, E. I. (2020). Analisis Literasi Digital Calon Guru Kimia Dalam Pelaksanaan Ppl Berbasis Virtual Di Masa Pandemi Covid-19. *Orbital: Jurnal Pendidikan Kimia*, *4*(2), 111-121.

[21]. Setyaningsih, R., Abdullah, A., Prihantoro, E., & Hustinawaty, H. (2019). Model penguatan literasi digital melalui pemanfaatan e-learning. *Jurnal Aspikom*, *3*(6), 1200-1214.

[22]. Silvana, H., & Darmawan, C. (2018). Pendidikan literasi digital di kalangan usia muda di kota bandung. *Pedagogia*, *16*(2), 146-156.

[23]. Üstündağ, M. T., Güneş, E., & Bahçivan, E. (2017). Turkish Adaptation of Digital Literacy Scale and Investigating Pre-service Science Teachers' Digital Literacy. *Journal of Education and Future*, (12), 19-29.

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