Exploring the correlation of self-perception on the use of digital literacy in learning

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ABSTRACT

The rapid development of technology in the era of the fourth industrial revolution requires teachers to have good digital literacy competencies to present interactive, current, and adaptive learning. In line with this condition, this research aims to map prospective teachers' digital literacy competency levels and explain the relationship between sub-areas of competency in digital literacy. The method used is quantitative, with validity testing using the reference value of item-total correlation, reliability testing using the reference value of Cronbach's alpha, and normality testing using the Kolmogorov-Smirnov test. The levels of prospective teachers' digital literacy competencies are mapped through descriptive quantitative analysis. Then, the correlation between competency areas is analyzed using bivariate correlation tests. The results of this study show that the majority of prospective teachers, accounting for 72.32%, have a moderate level of digital literacy competencies with a digital literacy index of 3.67. The relationship between measured sub-areas of digital literacy competencies shows a positive relationship. Still, it does not indicate a substantial correlation, indicating that more than the high scores on the digital literacy index and information is needed to support the competence of prospective teachers in creating digital content. This research is beneficial for higher education institutions in improving the digital literacy skills of prospective teachers. To enhance the digital literacy competencies of prospective teachers from a moderate level to a high level, there is a need for programs that strengthen the collaborative and communication sub-areas of competencies and programs that enhance the data and information literacy sub-areas.

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1. INTRODUCTION

The development of technology in the era of the Fourth Industrial Revolution is unavoidable. The existing technological advancements provide both convenience [1] and new challenges in all sectors, including the education sector [2], [3]. Teachers and educational institutions must be able to harness the available technological advancements [4] to provide engaging, up-to-date [5], [6], inspiring, reflective, enjoyable, and motivating learning experiences that encourage students to actively participate in learning [7], [8], while equipping them for a digitally connected future [9]. Teachers' digital literacy skills strongly support the ability to utilize technology in education, a fundamental skill that teachers must possess in the digital or big data era

[10]–[12]. Teachers with good digital literacy competencies can access various information, data, sources, and media to deliver high-quality educational processes [13], [14].

The term "digital literacy" was conceptually introduced by Paul Gilster in 1997 in his book "Digital Literacy" [15]. Still, it gained popularity and was formulated as part of the 21st-century skills framework [16]. Digital literacy can be defined as the activity of reading, writing, and creating new knowledge using digital devices [15], [17]–[19]. Digital literacy consists of several dimensions, and mapping these dimensions may vary from one source to another [20]–[22]. Digital literacy competencies can be categorized into three levels: digital competence, digital usage, and digital transformation [23]. Digital literacy is essential because technological changes have unavoidable implications for children. Technology usage has become a routine activity for Generation Alpha children in social media, gaming, and other purposes [24], [25].

However, this condition is not aligned with the level of digital literacy competencies in Indonesian society. Based on a survey conducted by KOMINFO, the level of digital literacy in Indonesian society is at an index of 3.47, with details of 3.17 for the information and data literacy sub-index, 3.38 for the communication and collaboration sub-index, 3.66 for the security sub-index, and 3.66 for the technology competence sub-index [26]. This index indicates that the society still has relatively poor digital literacy competencies or is at a "moderate" level. Several previous studies also indicate that the digital literacy competencies of teachers and prospective teachers in several countries are still inadequate [27]–[30]. Other studies on digital literacy also focus on teachers' perceptions of digital literacy [31], [32] and digital literacy enhancement programs [33].

Previous studies have provided information on digital literacy enhancement programs and described the levels of digital literacy competencies among teachers in education. However, there needs to be a specific mapping of digital literacy competencies based on each sub-area of digital literacy. Therefore, this research focuses on examining the competency levels of digital literacy candidates in each sub-area of competencies and analyzing the correlations between sub-areas of digital literacy competencies. The tested sub-areas of competencies include data and information literacy, communication and collaboration, and digital content creation competencies. Correlation analysis is essential because, in practical terms, an individual may have good competencies in one sub-area but lack in another sub-area of digital literacy. Correlation analysis can also reveal which sub-areas of competencies are closely related, guiding higher education institutions in determining the most effective programs to implement. Considering that teachers' digital literacy competencies need to be developed during their studies or when they are prospective teachers [34], [35], it is essential to identify digital literacy competencies early on, as good digital literacy competencies will significantly support their professional and pedagogical competence when they become teachers [36].

2. METHOD
2.1. Research technique
This study uses a quantitative design, a procedure for finding data and reaching conclusions. Data in this study are presented formally, based on a series of impersonal definitions, and using quantitative data [37], [38]. The technique used is a survey technique with 112 respondents. The survey was conducted using a questionnaire. The questionnaire consists of three competency areas developed in 36 statements.

2.2. Survey participants
The subjects of this study are prospective teachers in the Elementary Education Study Program at Sayyid Ali Rahmatullah Tulungagung State Islamic University, Indonesia. The respondents are prospective teachers in their 5th semester. This determination is based on the consideration that prospective teachers in the 5th semester have taken courses on learning, media, methods, and learning technology that are considered capable of supporting digital literacy competencies. The number of respondents in this study is 112, with 108 females and 4 males. This difference is because more female prospective teachers are in the program than male prospective teachers. However, gender is not a measurement category in this study.

2.3. Survey instrument
The survey instrument is in the form of a questionnaire consisting of several statements that cover areas of competency in digital literacy. These competency areas refer to the digital literacy guidelines issued by UNESCO. The areas of digital literacy indicate a person's level of digital literacy competency. To classify the level of digital literacy competency, the researcher refers to the digital literacy Europe (DigEulit) parameters and the index reference issued by the Indonesian Ministry of Communication and Information Technology.

2.4. Instrument validation

2.4.1. Validating the instrument theoretically

Theoretical validation of the instrument was carried out to obtain measurement results appropriate to the study context based on content, construction, and wording. The theoretical study of experts related to digital literacy was used to test the instrument rationally. The digital literacy competency questionnaire was compiled based on three competency areas. Firstly, information and data literacy consist of three indicators. Secondly, collaboration and communication comprise 6 indicators, and digital content creation consists of four indicators.

Digital literacy levels are categorized into three levels, level 1 is digital competence (consisting of information and data literacy competency), level 2 is digital usage (consisting of collaboration and communication competency), and level 3 is digital transformation (consisting of digital content creation competency). Information and data literacy competency includes the ability to browse, search, filter, evaluate, and manage data. Collaboration and communication competency consists of the ability to interact, share, engage through digital technologies, practice netiquette, and manage digital identity. Furthermore, digital content creation competency encompasses the ability to develop digital content, integrate and elaborate on it, understand copyright and licenses, and programming. The indicators of each sub-area of digital literacy competency are presented in Table 1.

After mapping the indicators into several statements, the next step is instrument validation. The survey instrument was validated by three experts: a content expert, a learning expert, and a language expert. The testing of the survey instrument was classified into five categories, namely very good, good, neutral (sufficient), poor, and very poor. If the validation of the instrument is rated as "very good", it means that the instrument has achieved a high standard and meets all the requirements. Therefore, it can be used without the need for any revisions. If the validation score is "good", it indicates that the instrument is good quality but requires minor revisions. If the instrument is categorized as "sufficient", it means several moderate revisions are needed for the instrument before it can be used. Once these revisions are made, the instrument can be used. If the instrument falls into the "poor" category, significant improvements are required to address deficiencies in the instrument. If the validation score of the instrument is "very poor", it means that the instrument requires extensive revisions or may be beyond salvageable. Therefore, the instrument is considered unusable in its current form. The criteria for the five categories are described in Table 2. Based on the results of the instrument validation by three validators showed that the developed instrument was good, so it can be used if it has been revised according to the suggestions and additions from the experts.

2.4.2. Empirical validation of the instrument

The empirical validation of the instrument is conducted to determine the quality of the research instrument that has been developed, ensuring its suitability for use. The empirical validation of the instrument is carried out on fifth-semester students of the PGMI study program. A total of 30 students are involved in the instrument pilot testing activity using a digital literacy questionnaire.

2.5. Research data analysis

The data collected on prospective teachers' self-perceptions of digital literacy competencies are utilized to create a comprehensive mapping of their competency levels. This mapping aims to explore the correlations between different areas of competency. The mapping process involves conducting a descriptive analysis focusing on various digital literacy competency level parameters. The Digital Literacy Index can be grouped into three criteria, poor, moderate, and good. The Digital Literacy Index is denoted by the symbol "x". If "x" is less than 3, it is categorized as "poor". This means that individuals already can use digital devices, but their skills have not yet reached the level of applying digital devices. If "x" is greater than or equal to 3 but less than 4, it falls into the "moderate" category. This indicates that individuals within this range have a moderate level of digital literacy, and their skills are already focused on using digital devices. Furthermore, if "x" is greater than or equal to 4, it is classified as "good." This indicates that individuals with a digital literacy index of 4 or higher are considered to have a high level of digital literacy. They have a strong understanding of digital tools and technologies, can use them effectively, and may have advanced skills in creating digital content. The parameters for mapping prospective teachers' digital literacy competence levels can be viewed in Table 3.

Once the mapping of digital literacy competency levels was completed, the researchers proceeded to analyze the relationships between different competency areas using correlation analysis. The correlation analysis specifically examined the interrelationships between data and information literacy competency, communication and collaboration competency, and digital content creation competency. By conducting this analysis, the researchers aimed to gain insights into the extent to which these competency areas are interconnected and how they influence each other within the context of digital literacy.

Table 1. The indicators of digital literacy competency

Digital literacy level	Competency area	Indicators	Statement items
Digital competence	1. Information and data literacy	1.1 Browsing, searching, and filtering data, information, and digital content	Ability to search for required data and information well
			Ability to select required data and information well
			Ability to choose and select various required information or data from various sources
			Ability to evaluate the usefulness of a source or data
			Ability to determine appropriate keywords to find required data and information well
		1.2 Evaluating data, information, and digital content	Ability to determine accurate or inaccurate data and information
			Ability to consider risk mitigation before distributing information, data, or content
			Ability to consider the appropriate way and platform to distribute information, data, or content
		1.3 Managing data, information, and digital content	Able to manage/organize data through some applications well
			The applications that are usually used for managing data include...
			The ability to analyze data quantitatively and qualitatively
Digital usage	2. Collaboration and communication	2.1 Interacting through digital technologies	Ability to know the types of electronic interactions and transactions in digital space following applicable regulations
			Always prioritize ethical values in interacting in digital space
			Ability to interact well in communicating online, both in social media and online meetings
		2.2 Sharing through digital technologies	Actively participating in sharing good and ethical information through social media or other digital devices
			Ability to use appropriate language rules when communicating with older, peer, or younger people through social media/other digital devices
		2.3 Engaging in citizenship through digital technologies	Understand how to live in a society in the digital world, including not doing things that can harm other internet users.
		2.4 Collaborating through digital technologies	Knowing how to collaborate in digital space by applicable norms, ethics, and regulations
			Knowing the platforms that can be used for collaboration
			The platforms for collaboration that are known include...
			Understand the various regulations that apply when collaborating in digital space
			The ability to collaborate with various communities or elements to publish information/data or content
		2.5 Netiquette (*etiket berinternet/tata krama dalam berinternet*)	Understand the importance of applying ethics on the internet
			Understand what should and should not be uploaded when using social media or other digital devices
			Able to distinguish between fake and genuine information
			Understand the impact when becoming the maker/distributor of information, data, or content containing hoaxes, hate speech, pornography, bullying, and other negative content
		2.6 Managing digital identity	Respect others' privacy in the digital world.
			Provide constructive comments on digital media/other digital devices.
			Ability to manage information, data, or content by netiquette standards.
Digital transformation	3. Digital content creation	3.1 Developing digital content	Ability to create good learning content.
			Ability to create digital learning media/sources well.
			Ability to accurately organize new information or content and pay attention to ethics.
		3.2 Integrating and re-elaborating digital content	Ability to elaborate digital content with appropriate learning material.
			Ability to use various forms of digital content to create new works.
		3.3 Copyright and licenses	Always include reference sources when writing information, data, or content to respect others' copyrights.
		3.4 Programming	Ability to create simple programs in creating learning media.
			Ability to perform simple programming using applications.

Table 2. Instrument validation category

Category	Description
Very good	Can be used without revision
Good	Can be used with minor revisions
Sufficient	Can be used with moderate revisions
Poor	Can be used with extensive revisions
Very poor	Cannot be used

Table 3. Digital literacy competency level parameters [26]

Digital literacy index	Criteria
x<3	Poor
3<x<4	Moderate
x≥4	Good

As a prerequisite test for the instrument, the questionnaire was tested for its validity (using item-total correlation reference) and reliability (using Cronbach alpha value reference). From the validity and reliability test results, it was found that 6 items had low compatibility and were therefore excluded. From the remaining 32 statements, 26 items were tested for their validity and reliability. These 26 items consisted of 13 domains: i) Browsing, searching, and filtering data, information, and digital content; ii) Evaluating data, information, and digital content; iii) Managing data, information, and digital content; iv) Interacting through digital technologies; v) Sharing through digital technologies; vi) Engaging in citizenship through digital technologies; vii) Collaborating through digital technologies; viii) Netiquette; ix) Managing digital identity; x) Developing digital content; xi) Integrating and re-elaborating digital content; xii) Copyright and licenses; xiii) Programming.

Correlation analysis was performed using bivariate correlation tests, correlating the relationship between several competency areas. Correlation tests were conducted to see the relationship between data and information literacy competency with digital content creation competency and the relationship between communication and collaboration competency with digital content creation competency. The aim was to observe the degree and form of correlation that was formed. Several tests used in this study utilized IBM SPSS 24.0.

3. RESULTS AND DISCUSSION

3.1. Results of instrument test

The first test conducted was the validity test. The validity test was performed using the bivariate correlation technique. The results showed that in the data and information literacy competency sub-area, there were 2 items with low corrected item-total correlation. These items were item no. 3 (under the indicator of browsing, searching, and filtering data, information, and digital content) and item no. 11 (under the indicator of managing data, information, and digital content), with the respective Pearson correlation values of 0.264 and -0.026. Furthermore, there were 4 items with low corrected item-total correlation in the communication and collaboration competency sub-area. These items were items 3, 8, 13, and 16, with Pearson correlation values of 0.305, 0.262, 0.187, and 0.304, respectively. Next, in the digital content creation competency sub-area, there were 5 items with acceptable item-total correlations, ranging from 0.616 to 0.882. Thus, the questionnaire consisted of 26 statements divided into three categories, with a total number of problematic items.

After the validity of the instrument is tested, the next step is to conduct a reliability test. The reliability test results showed that the Cronbach alpha values for the literacy and data competency area are 0.816, the communication and collaboration competency area is 0.779, and the content creation competency area is 0.803. These values indicate that the instrument has been tested for reliability with Cronbach alpha values >0.6. The reliability test results are presented in Table 4.

The questionnaire tested for its validity and reliability is then used as a data collection instrument to assess prospective teachers' digital literacy competence from a self-perception perspective. The data collected from 112 respondents are normally distributed. Normality test using the one-sample Kolmogorov-Smirnov test shows a significance value of 0.200 or more than 0.05. From the histogram shape, it can be seen that all items are within the lines, and the highest peak is right in the middle of the curve, as depicted in Figure 1.
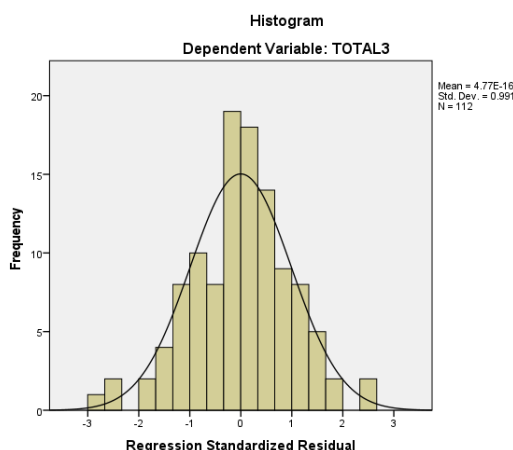
3.2. Level of digital literacy competence

The level of digital literacy competency among prospective teachers, based on self-perception, is classified into three categories: "good", "moderate", and "poor". Prospective teachers with "good" digital literacy competencies have an average score of 4 or higher. Those with an average score of 3 or higher but less than 4 falls into the "moderate" category, while those with an average score below 3 falls into the "poor" category. Based on the collected data, it is known that in the sub-area of data and information literacy, the ability of prospective teachers is at an index of 3.86. In the sub-area of communication and collaboration, prospective teachers' ability is at an index of 3.61. In the sub-area of digital content creation, the ability of prospective teachers is at an index of 3.54. Based on these three competency sub-areas, prospective teachers' average digital literacy competence is obtained at an index of 3.67, which is in the "moderate" range and has not reached the "good" level. The magnitude of the index for each sub-area of digital literacy competence can be seen in Figure 2.

Table 4. Reliability test results

Competency areas	r_{xy}	R table	Description
Information and data literacies	0.816	0.361	Reliable
Communication and collaboration	0.779	0.361	Reliable
Content creation	0.803	0.361	Reliable

*Correlations' significance: p<.005 (2-tailed)

* The total of 3 represents the total value of the dependent variable, which is the area of digital content competency.
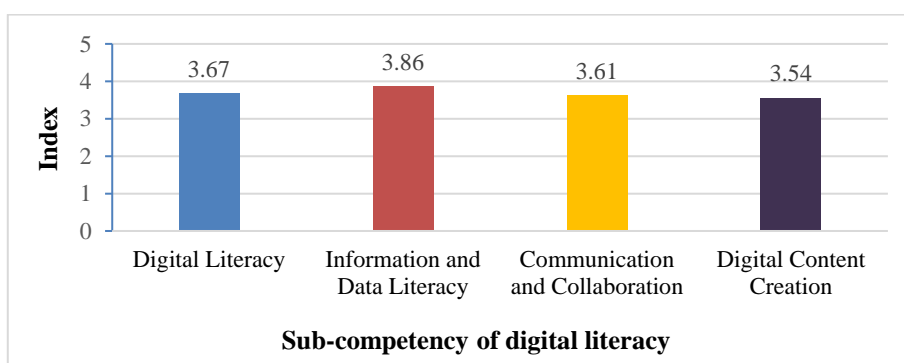
Figure 1. Normality test results

Figure 2. Digital literacy index

The survey results indicate that the level of digital literacy competency among prospective teachers is at 3.67, which falls within the "moderate" range. This finding is consistent with the survey conducted by KOMINFO Indonesia in 2020, which showed that the digital literacy ability of Indonesian society is still at the "moderate" level, with a score of 3.47 [26]. Referring to the digital literacy framework proposed by Martin, the "moderate" level corresponds to Level II or digital usage. Digital usage includes using various software, solving basic problems on digital devices, using technology to complete tasks, and communicating effectively [39]. One indicator of digital literacy competency at the "moderate" level (digital usage) is the ability to use various software [39]. In this study, prospective teachers' proficiency in using multiple software is evident from their acknowledgment that they are familiar with the use of software required in their studies, such as PowerPoint, Prezi, Canva, Kinemaster, Lectora, Powtoon, Picsart, Ancor, VN, Ibis Paint, Capcut, Komik live, and wizer.me. There are 45.38% of the total number of teacher candidates who can use the PPT and Canva applications. Among them, 17.65% are capable of using PPT, Canva, and Prezi. 11.76% can only use the PPT application, while 7.56% can only use Canva. Additionally, 2.52% can use PPT, Canva, Powtoon, and Prezi. 1.68% can use PPT, Canva, and Kinemaster, while another 1.68% can use PPT, Canva, Prezi, and Lectora. The remaining percentage is less than 1% and consists of teacher candidates who can use Picsart, Ancor, VN, Ibis paint, Komik Live, Capcut, and wizer.me. The percentage of prospective teachers who can use a variety of software is depicted in Figure 3.
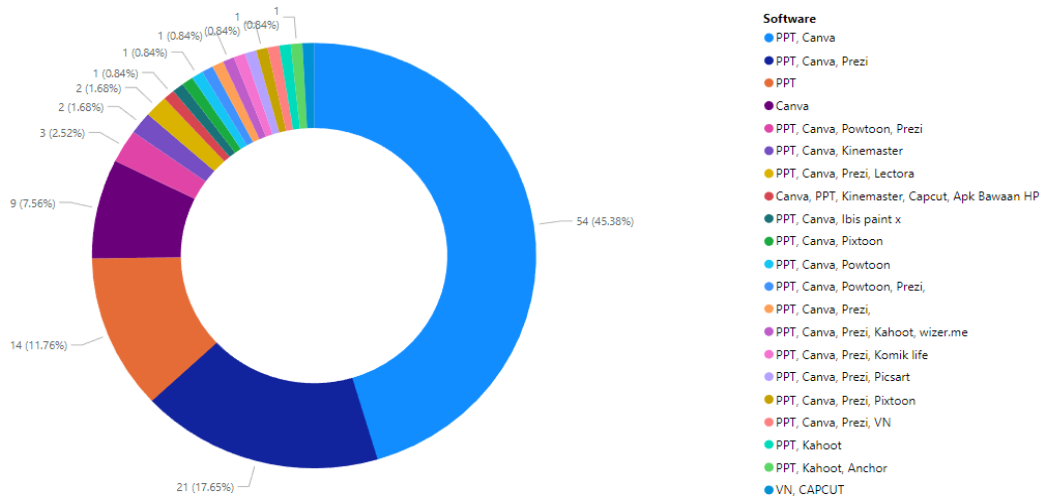
Figure 3. Software mastered by prospective teacher

Based on the diagram, it is evident that prospective teachers possess the ability to utilize diverse software tools to generate digital content specifically for educational purposes. Nevertheless, it is essential to note that, at present, prospective teachers are confined to the role of software users and have yet to attain the stage of digital transformation. This implies that while they demonstrate proficiency in using digital tools, there is still progress in fully integrating technology into their educational practices and embracing a transformative approach to digital learning.

The levels of digital literacy competency are then examined specifically in each sub-area of digital literacy, which includes i) data and information literacy; ii) communication and collaboration; and iii) digital content creation. Regarding data and information literacy, the results show that 40.18% of prospective teachers have good competency, 58.04% have moderate competency, and 1.79% have poor competency. Moving on to communication and collaboration, 21.43% are at a good level, 75.89% are at a moderate level, and 2.68% are at a poor level. As for digital content creation, the results indicate that 0.89% of prospective teachers have good competency, 83.04% have moderate competency, and 16.07% have poor competency. The detailed levels for each sub-area of competence are presented in Table 5.

Table 5. The percentage of prospective teacher's competence in each sub-area of digital literacy

	Competency	Competencies level	Percentage
Index	Digital literacy	Good	20.83
		Moderate	72.32
		Poor	6.85
Sub-index	Information and data literacies	Good	40.18
		Moderate	58.04
		Poor	1.79
	Communication and collaboration	Good	21.43
		Moderate	75.89
		Poor	2.68
	Digital content creation	Good	0.89
		Moderate	83.04
		Poor	16.07

The data indicate that among the three areas of digital literacy competency, the lowest scores are found in digital content creation. This is in line with previous research [40] that highlights the need for more intensive development of digital literacy competency, particularly in digital content creation. Sharpening skills in creating digital content is crucial as it requires the ability to browse, search, and evaluate data and information effectively. Furthermore, to optimize content creation, proficiency in digital communication and collaboration is also necessary [41].

The competency of digital content creation through Bloom's taxonomy falls under the cognitive dimension of level 6 (C6) [42], which involves the ability to create. Therefore, there is a need for a program to enhance digital literacy competency in higher education institutions to elevate the level of digital literacy

competency among future teachers. To design an effective program, it is important to identify which elements correlate most strongly with digital content creation skills (digital literacy level 3). Thus, a correlation analysis among the three sub-areas of digital literacy competency is necessary.

3.3. The correlation of competency area in digital literacy

The relationship between these competency areas is then tested with a correlation test to determine the relationship between data and information literacy, communication and collaboration, and digital content creation competencies. In this correlation test, the communication and collaboration competency area is the dependent variable, and data and information literacy and communication and collaboration competency areas are the independent variables. The first correlation test examines the relationship between data and information literacy competency and digital content creation. The results of the correlation test showed that there is a relationship between these two competency areas with a significance value of 0.112. However, looking at the degree of Pearson Correlation value, the relationship formed is weak, 0.368 or between 0.21 and 0.40. The results of the correlation test between the sub-areas of data and information literacy competence and digital content creation are presented in Table 6.

Table 6. Correlation test results between digital content and information-data literacy

		Digital content	Communication and collaboration
Digital content	Pearson Correlation	1	.368**
	Sig. (2-tailed)		.000
	N	112	112
Information and data literacy	Pearson Correlation	.368**	1
	Sig. (2-tailed)	.000	
	N	112	112

**. Correlation is significant at the 0.01 level (2-tailed)

The second correlation test examines the relationship between communication and collaboration competency and digital content creation. The results of the correlation test showed that there is a relationship between these two competency areas with a significance value of 0.112. Looking at the degree of Pearson Correlation value, the correlation formed is moderate, 0.520 or between 0.41 and 0.60. The results of the correlation test between the sub-areas of communication and collaboration competence and digital content creation are presented in Table 7.

Table 7. Correlation test results between digital content and communication-collaboration

		Digital content	Communication and collaboration
Digital content	Pearson Correlation	1	.520**
	Sig. (2-tailed)		.000
	N	112	112
Communication and collaboration	Pearson Correlation	.520**	1
	Sig. (2-tailed)	.000	
	N	112	112

**. Correlation is significant at the 0.01 level (2-tailed)

The results of both correlation tests indicate a significant relationship between the measured areas of digital competency in this study. Both data and information literacy competency and communication and collaboration competency influence the ability of future teachers to create digital content in education. When considering the type of relationship formed, both show a positive correlation. This means that as data and information literacy competency improve, the competency in digital content creation also increases, and vice versa.

At least two correlations can be observed in this study. First, there is a correlation between the area of data and information literacy competency and the area of digital content creation, with a Pearson Correlation value of 0.368. This value indicates a weak and positive relationship. The positive relationship suggests that higher data and information literacy skills are associated with higher abilities in creating digital content. However, due to the weak correlation, prospective teachers who have good data and information literacy skills may not necessarily demonstrate strong digital content creation abilities. Second, communication and collaboration competency correlate with digital content creation, with a Pearson Correlation value of 0.520. This value indicates a moderate and positive relationship. The positive relationship means that higher communication and collaboration skills are associated with higher abilities in creating digital content.

The correlation analysis of the three sub-areas of digital literacy competency illustrates that if universities want to improve the digital literacy competency of future teachers, they need to enhance their digital communication and collaboration skills first. Through effective communication and collaboration skills, future teachers will be better equipped to independently improve their digital literacy skills, supporting their competency in creating digital content. When future teachers have strong digital content creation abilities, it will have a positive impact on the implementation of the curriculum [43] and enhance their pedagogical competence. Good digital literacy competency influences better learning achievement [44].

4. CONCLUSION

This research concludes that most prospective teachers claim to have a sufficient/moderate (3.67) level of digital literacy competence. Digital literacy competence is measured in several areas of competence, including data and information literacy, communication and collaboration, and digital content creation. These competencies have positive correlations. The relationship between data and information literacy competence and digital content creation is weak (Pearson Correlation value of 0.368) and positive. The relationship between communication and collaboration competence and digital content creation is moderate and positive (with a Pearson Correlation value of 0.520). These results indicate that competence in data and information literacy, as well as competence in collaboration and communication, can strengthen digital content creation competence.

This research can provide benefits to society by providing information on the importance of utilizing technology in learning in the era of the industrial revolution 4.0. In addition, by conducting a correlation analysis of self-perception on the use of digital literacy, the study can provide a better understanding of how effective the use of technology is in learning. This can assist prospective teachers, teachers, and parents select the appropriate technology and maximize its use in the learning process. By utilizing technology effectively, it is hoped that the quality of education and the abilities of the younger generation in facing future challenges can be improved.

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