REFLECTION JOURNAL
https://journal-center.litpam.com/index.php/RJ
reflectionjournal21@gmail.com

June, 2025 Vol. 5, No. 1
e-ISSN: 2808-1501
pp. 438-448

Analysis of Digital Literacy and Creativity of Prospective Teacher Students in Project-Based Lectures with Hybrid Mode

[1*] Hikmawati, [2] Bagdawansyah Alqadri, [3] Muhammad Syazali, [4] Dodiy Firmansyah, [1]Lisa Mardiana

[1] Pendidikan Fisika, FKIP, Universitas Mataram, Jl. Majapahit No. 62, Mataram, Indonesia
[2] PPKn, FKIP, Universitas Mataram, Jl. Majapahit No. 62, Mataram, Indonesia
[3] PGSD, FKIP, Universitas Mataram, Jl. Majapahit No. 62, Mataram, Indonesia
[4] Pendidikan Kimia, FKIP, Universitas Mataram, Jl. Majapahit No. 62, Mataram, Indonesia
*Corresponding Author e-mail: hikmawati@unram.ac.id

Diterima: Mei Tahun; 2025 Revisi: Mei Tahun; 2025 Diterbitkan: Juni 2025

Abstract

This study aims to analyze the level of digital literacy and creativity of students in hybrid mode lectures that apply the Project Based Learning (PjBL) model. The subjects of the study were 31 second-semester students of the Physics Education Study Program, FKIP, University of Mataram who took the Professional Education lecture. The study was conducted in 6 meetings from March 18 to May 27, 2025. This study used a quantitative and qualitative descriptive approach. Data were collected through digital literacy questionnaires and creativity tests, as well as documentation of student project products. Pearson correlation was used to see the relationship between digital literacy variables and student creativity. The results showed that the majority of students had high levels of digital literacy and creativity. Students were able to produce innovative digital products in the form of powerpoints with attractive illustrations and relevant learning video links. The application of the PjBL model in hybrid mode has been proven to provide space for exploring ideas, encouraging collaboration, and increasing the use of digital technology creatively. Despite challenges such as limited devices and time management in online group work through SPADA UNRAM, overall the PjBL model in hybrid mode is effective in developing two main competencies of the 21st century, namely digital literacy and creativity. There is a significant correlation between digital literacy and student creativity, the higher the digital literacy, the greater the student's creativity. This study recommends the continuous integration of project-based learning in technology-based curriculum design to equip students as prospective adaptive and innovative physics teachers.

Keywords: Digital Literacy; Creativity; Project; Hybrid; Prospective Teacher.

***How to** Cite:* Hikmawati, H., Alqadri, B., Syazali, M., Firmansyah, D., & Mardiana, L. (2025). Analysis of Digital Literacy and Creativity of Prospective Teacher Students in Project-Based Lectures with Hybrid Mode . *Reflection Journal*, *5*(1), 438–448. https://doi.org/10.36312/rj.v5i1.2966

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INTRODUCTION

The development of information and communication technology has had a significant impact on various aspects of life, including higher education (Sari & Alfiyan, 2023). Universities are now required to continue to innovate in designing and implementing learning processes that are not only adaptive to the times, but also able to prepare students to face the challenges of the digital era (Suhardiman & Kamaluddin, 2022). One form of innovation that is starting to be widely adopted is lectures with a hybrid mode, which combines the advantages of face-to-face learning (offline) and online learning in one integrated learning system (Laksono, 2021). Hybrid mode is considered capable of answering the needs of flexible, efficient learning, and maintaining the quality of interaction between lecturers and students or students and students (Khauzanah & Wardani, 2023). Offline learning can provide direct experience, field practice, and character building, while online learning allows access to extensive learning resources and more independent learning (Abimanik et al., 2022). In practice, students are required to develop various skills, including the ability to adapt, learn independently, and use digital technology in the learning process. The hybrid mode provides space for student teachers to access, evaluate, and create digital information critically and complete projects collaboratively through the use of technology. In the context of project-based learning, students not only act as recipients of knowledge, but also as creators of digital content, which requires creative thinking, problem-solving skills, and technological literacy. Thus, the hybrid mode not only supports personalization and accessibility of learning, but also strengthens the

integration of knowledge, digital skills, and creative expression in an authentic and contextual learning context (Ulfah, 2020).

In the context of higher education, two important competencies that are very relevant in hybrid learning are digital literacy and student creativity (Wajdi et al., 2021). Creativity is needed to generate new ideas, think critically, solve problems, and develop innovative products or projects. Meanwhile, digital literacy includes the ability to understand, evaluate, and utilize digital technology and information effectively and ethically (Suherman et al., 2020). Both are important parts of 21st-century skills that are indicators of successful learning in the digital era. The learning model that is considered capable of developing both competencies is Project Based Learning (PjBL). PjBL is a learning model that emphasizes in-depth investigation of a topic or real problem through the implementation of projects designed and completed by students collaboratively (Tong et al., 2022). This model allows students to integrate knowledge, skills, and technology into a meaningful learning unit. Thus, PjBL not only improves conceptual understanding, but also hones creativity, high-level thinking skills, and digital literacy skills. In addition, the methodological approaches used in previous studies tend to focus on perception surveys or descriptive studies, while this study adopts a more holistic approach through the direct implementation of project-based learning in a hybrid mode. This study offers a new contribution by more comprehensively investigating how the combination of pedagogical strategies and technology supports the development of digital literacy and creativity simultaneously in the context of pre-service teachers (Basri et al., 2023).

The implementation of PjBL in hybrid mode presents its own challenges and opportunities. On the one hand, the use of digital technology in online learning allows students to explore various sources of information, collaborate virtually, and present project results in various forms of digital media. On the other hand, not all students have the same readiness in terms of technology use, time management, and the ability to work independently or in teams. This has the potential to affect the development of digital literacy and student creativity in the learning process. Along with the transformation of learning in higher education, it is important to evaluate the effectiveness of the learning model applied. In this case, the analysis of digital literacy and student creativity in the implementation of hybrid-based PjBL is very relevant to do (Singh et al., 2021). This study not only provides an overview of the extent to which these two competencies have developed, but can also be a basis for improving learning design in the future. Lecturers as learning facilitators also need concrete data regarding the effectiveness of the learning model used so that the learning process can be more focused and have a real impact on the development of student competencies. This study advances the discourse on digital education by simultaneously exploring the direct link between hybrid pedagogical strategies, digital literacy, and creativity, and emphasizing the urgency of integrating 21st-century skills in pre-service teacher education empirically and contextually (Selegi & Aryaningrum, 2022).

In addition, this analysis can help higher education institutions to understand the actual conditions of students in facing the digital era. For example, whether students are able to use digital technology wisely, are able to work collaboratively in networks (through SPADA UNRAM), and have the ability to think creatively in completing project-based tasks (Chamisijatin et al., 2023). This understanding is important considering that students are prospective graduates who will later contribute to the world of work and society which is full of global challenges and very rapid technological changes. On the other hand, the development of creativity and digital literacy is not only determined by the learning model used, but is also influenced by other factors such as infrastructure readiness, quality of guidance from lecturers, availability of access to technology, and motivation and individual characteristics of students (Baliya & Shikha, 2023). Therefore, this study also needs to pay attention to supporting and inhibiting factors in the implementation of hybrid PjBL. The findings from this aspect will be valuable input in designing learning policies and strategies in higher education, especially in the Physics Education Study Program, FKIP, University of Mataram (Sasabillah et al., 2023).

Furthermore, by conducting an in-depth analysis of digital literacy and student creativity, this study is expected to provide theoretical and practical contributions. Theoretically, this study enriches the study of the effectiveness of project-based learning in a hybrid context (Çiftçi, 2020). Practically, the results of this study can be used by lecturers, curriculum developers, and institutional leaders to develop learning models that are more in line with the needs of students in the digital era (Sanpanich, 2021). Thus, the

research entitled "Analysis of Digital Literacy and Student Creativity in Hybrid Mode Lectures with Project Based Learning (PjBL) Model" is important and relevant to be conducted. This research is expected to provide a comprehensive picture of how students develop their digital literacy and creativity in the context of project-based hybrid learning, as well as identify strategies that can be implemented to improve the effectiveness of learning in order to produce creative, adaptive, and digitally literate graduates. In this study, the main indicators used to measure digital literacy include the ability to access, stream, manage, and create digital information ethically and responsibly. These domains include technical aspects such as mastery of digital tools, cognitive such as the ability to think critically about bold information, and socio-emotional such as digital ethics and cybersecurity (Mursid et al., 2022). Meanwhile, digital creativity is measured based on dimensions in generating various original ideas, fluency in using digital media to convey ideas, and adaptive ability in solving problems through innovative technology-based approaches. These indicators were chosen because they reflect the main skills of the 21st century that are highly relevant to prospective teacher students in the context of project-based learning and the integrated use of digital technology (Rahmawati & Suharyati, 2022).

METHOD

This research uses a descriptive quantitative approach with the aim of analyzing the level of digital literacy and creativity of students in hybrid mode lectures that implement the Project Based Learning (PjBL) model. This approach was chosen to obtain an objective and systematic picture of the student competency profile in the context of project-based learning supported by digital technology. The subjects in this study were second semester students of the Physics Education Study Program, FKIP, University of Mataram. The number of research subjects was 31 students, who took lectures with a hybrid mode that implemented the Project Based Learning model. This research was conducted in 6 meetings, for three months, starting from March 2025 to May 2025 as shown in Table 1. The data collection process was carried out while students were taking hybrid project-based lectures. Learning activities took place in a combined manner, namely face-to-face meetings in class and online meetings through the SPADA UNRAM learning platform which is accessed on the page https://daring.unram.ac.id/.

Table 1. Meetings and Lecture Materials

Meeting	Date	Lecture Materials
1st	18 March 2025	Teacher Competence
2nd	25 March 2025	Continuous Professional Development of Teachers
3rd	8 April 2025	Teacher Performance Assessment
4th	22 April 2025	Teacher Career Development
5th	6 May 2025	Review of the Speeches of the Minister of Primary and Secondary Education and the Minister of Science and Technology on Deep Learning and Impactful Campuses Reviewed from the Aspect of Prospective Teacher Students
6th	27 May 2025	Protection and Respect for Teachers

Online lecture activities through SPADA UNRAM are shown in Figure 1. Lecturers provide lecture material file attachments as the main reference. Lecturers direct students to find relevant references in the form of e-books or scientific articles in accredited national journals and reputable international journals. Lecturers also prepare a group discussion menu, for questions and answers related to learning topics, lecturers as facilitators and provide material reinforcement at face-to-face meetings in class. Project assignments are given to students in the form of making powerpoints that must be accompanied by interesting illustrations and relevant video links.

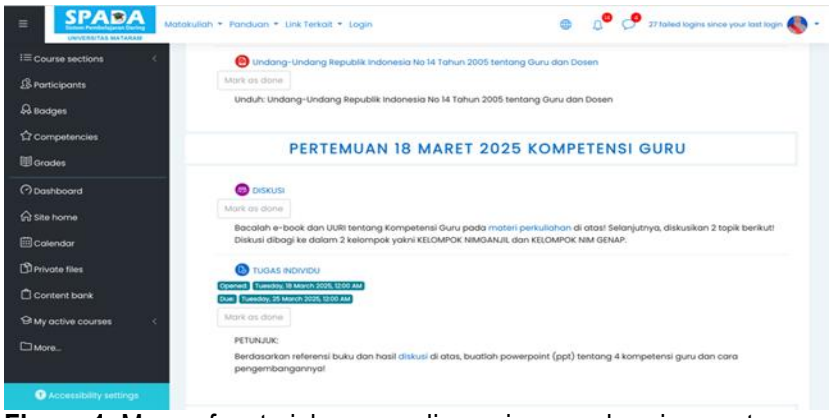

Figure 1. Menu of materials, group discussions, and assignments

Group discussion activities are divided into odd and even groups. The lecturer provides a topic as a group discussion material for each group. Each group will conduct an online Q&A related to the topic given. Reference materials in the form of e-books and relevant laws and regulations as well as scientific articles are sources of learning for students in conducting online discussions through SPADA UNRAM. Face-to-face lectures are conducted for material consolidation activities and guidance in conducting discussions and completing project assignments. The division of discussion groups is shown in Figure 2.

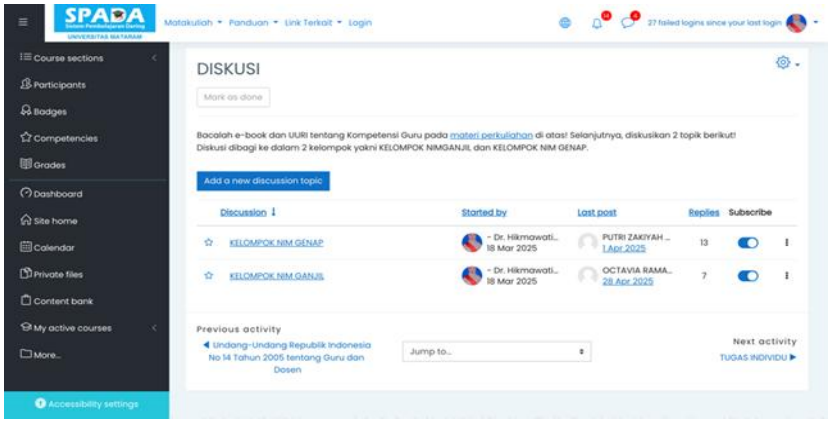

Figure 2. Group discussions are divided into odd and even groups

The topic of group discussion is facilitated by the lecturer, namely in the form of contextual problems. The problems in question are cases related to the world of education, including cases related to prospective physics teachers in high school. Group members provide responses to the topic, namely by writing down examples of problems obtained from experience or national and international news information. Other students will provide responses, even providing cases or examples of similar problems. Responses are also in the form of opinions related to other cases of the physics learning process. The discussion process through SPADA UNRAM is shown in Figure 3.

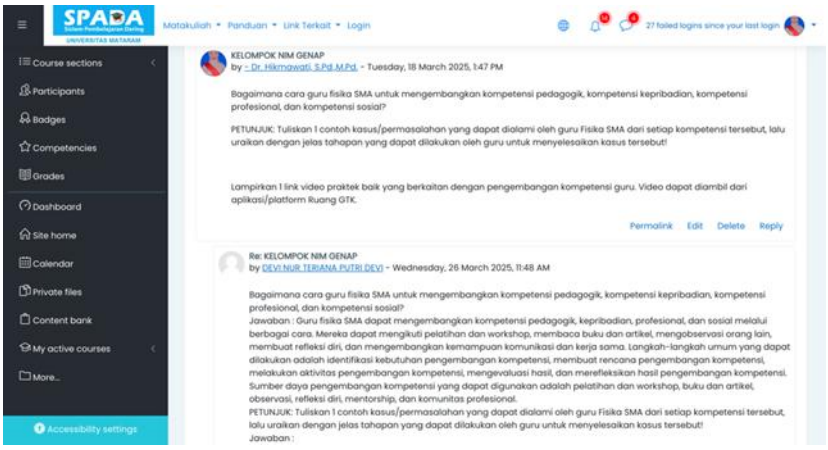

Figure 3. Lecturer-student and student-student discussion activities

The learning model used in lecture activities is Project Based Learning (PjBL) which is developed in five main stages, namely: (1) determining basic questions, (2) designing project planning, (3) preparing a schedule, (4) monitoring project progress, and (5) evaluating results and providing reflection. The implementation of PjBL is carried out in a hybrid format, utilizing the Learning Management System (LMS), online discussion forums, and synchronous and asynchronous project presentations. During the learning process, students are asked to complete projects based on learning themes, the results of which are compiled in digital form (powerpoint/ppt). Interaction and collaboration are carried out both directly and online, allowing researchers to observe the extent to which students' digital skills and creativity are involved in the process.

Data collection was conducted using two types of instruments, namely: digital literacy questionnaires and student creativity tests. First, the Student Creativity Test; This test instrument consists of 5 essay test items, which measure the dimensions of originality, flexibility, elaboration, fluency, and imagination. Second, the Digital Literacy Questionnaire; This instrument includes 5 indicators, namely Access to Digital Information, Information Evaluation, Use of Digital Tools, Digital Content Creation, and Digital Ethics. The instrument consists of 10 statement items, with a Likert scale. In addition to tests and questionnaires, researchers also use student project documentation as supporting data to see the results of digital work and creativity concretely in the products produced by students.

Data obtained from the digital literacy questionnaire and student creativity test were analyzed descriptively quantitatively. Descriptive statistics were used to calculate the mean value, standard deviation, and category of students' creativity and digital literacy levels. The category criteria were classified into five levels, namely very high, high, medium, low, and very low, based on the distribution of total scores. Furthermore, project documentation data were analyzed qualitatively-descriptively to provide a deeper picture of the form of creativity and the use of digital literacy in the products produced. In addition, the Pearson correlation test was used to see the relationship between digital literacy variables and student creativity variables. These findings were used to strengthen the results of the quantitative analysis.

RESULT AND DISCUSSION

This study aims to analyze the impact of implementing project-based learning in hybrid mode on digital literacy and creativity of student teachers. The subjects of the study were 31 second semester students of the Physics Education Study Program who took the Professional Education course. Data were collected through a Digital Literacy questionnaire and creativity test. The results of data processing are presented in Table 2.

Table 2. Descriptive data on digital literacy and student creativity

Descriptives				
			Statistic	Std. Error
Digital Literacy	Mean		84.8387	0.95838
	95% Confidence Interval for Mean	Lower Bound	82.8814	
		Upper Bound	86.7960	
	5% Trimmed Mean		84.9319	
	Median		86.0000	
	Variance		28.473	
	Std. Deviation		5.33602	
	Minimum		74.00	
	Maximum		94.00	
	Range		20.00	
	Interquartile Range		10.00	

	Skewness		-0.236	0.421
	Kurtosis		-1.020	0.821
Student Creativity	Mean		80.5161	1.02430
	95% Confidence Interval for Mean	Lower Bound	78.4242	
		Upper Bound	82.6080	
	5% Trimmed Mean		80.4624	
	Median		80.0000	
	Variance		32.525	
	Std. Deviation		5.70305	
	Minimum		72.00	
	Maximum		90.00	
	Range		18.00	
	Interquartile Range		10.00	
	Skewness		0.016	0.421
	Kurtosis		-1.215	0.821

Most students showed high digital literacy, with an average score of 84.84. The lowest and highest scores for the digital literacy variable were 74.00 and 94.00. This shows that the hybrid mode in project-based learning is generally able to improve students' digital literacy, although obstacles are still found in some individuals. Students' creativity scores showed a fairly even distribution, with scores ranging from 72.00 to 90.00, and an average of 80.52. This reflects good mastery of the material after participating in project-based learning in hybrid mode (Herawati et al., 2023; Saravanan et al., 2022).

The assumptions of the Pearson correlation test (between digital literacy variables and student creativity) in this study have been met, namely: both variables are measured on an interval scale, the two continuous variables can be paired, there is independence of observations, there are no significant outliers, normally distributed, homoscedasticity (residuals are evenly distributed), and the relationship between the two variables is linear. The results of the linearity assumption test are shown in Figure 4. Based on the resulting scatterplot, digital literacy has a linear relationship to student creativity.

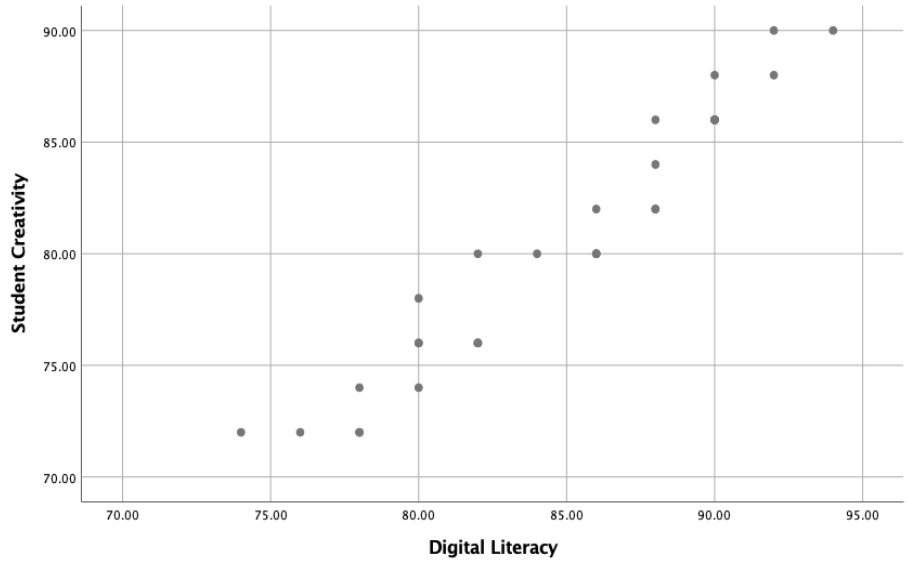

Figure 4. Scatterplot of linearity test

The assumption of homoscedasticity is met based on the scatter plot produced between the regression standardized predicted value variables and the regression standardized residual. The scatter plot of homoscedasticity is shown in Figure 5.

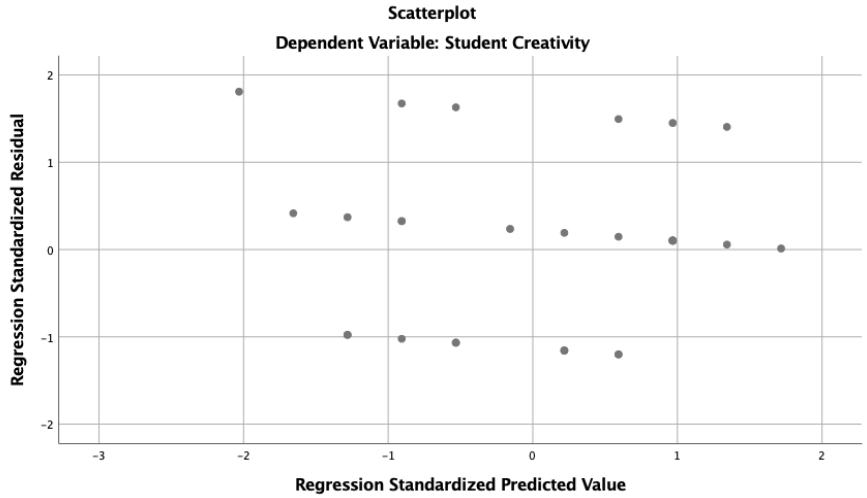

Figure 5. Scatterplot of homoscedasticity

The results of the Kolmogorov-Smirnov test inform that digital literacy data [D(31) = 0.143, p = 0.110] and student creativity data [D(31) = 0.154, p = 0.058] are normally distributed. The results of the data normality test are shown in Table 3. Similar information from the Shapiro-Wilk test is that digital literacy data [D(31) = 0.950, p = 0.157] and student creativity data [D(31) = 0.933, p = 0.054] are normally distributed.

Table 3. Results of the Kolmogorov-Smirnov and Shapiro-Wilk tests

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Digital Literacy	0.143	31	0.110	0.950	31	0.157
Student Creativity	0.154	31	0.058	0.933	31	0.054
a. Lilliefors Significance Correction						

The results of the Pearson Correlation test show that digital literacy has a significant relationship with student creativity, r = 0.967, p = 0.001, N = 31. The Pearson Correlation is shown in Table 4.

Table 4. Pearson Correlation

Correlations			
		Digital Literacy	Student Creativity
Digital Literacy	Pearson Correlation	1	.967**
	Sig. (2-tailed)		0.000
	N	31	31
Student Creativity	Pearson Correlation	.967**	1
	Sig. (2-tailed)	0.000	
	N	31	31
**. Correlation is significant at the 0.01 level (2-tailed).			

Figure 6 shows that the higher the digital literacy, the greater the creativity of students. From the documentation of student projects, it was found that students were able to produce diverse and innovative digital products, in the form of powerpoint (ppt) with interesting image illustrations and relevant video attachments. This PPT can be used as a learning medium, a source of student learning (Anisa et al., 2023).

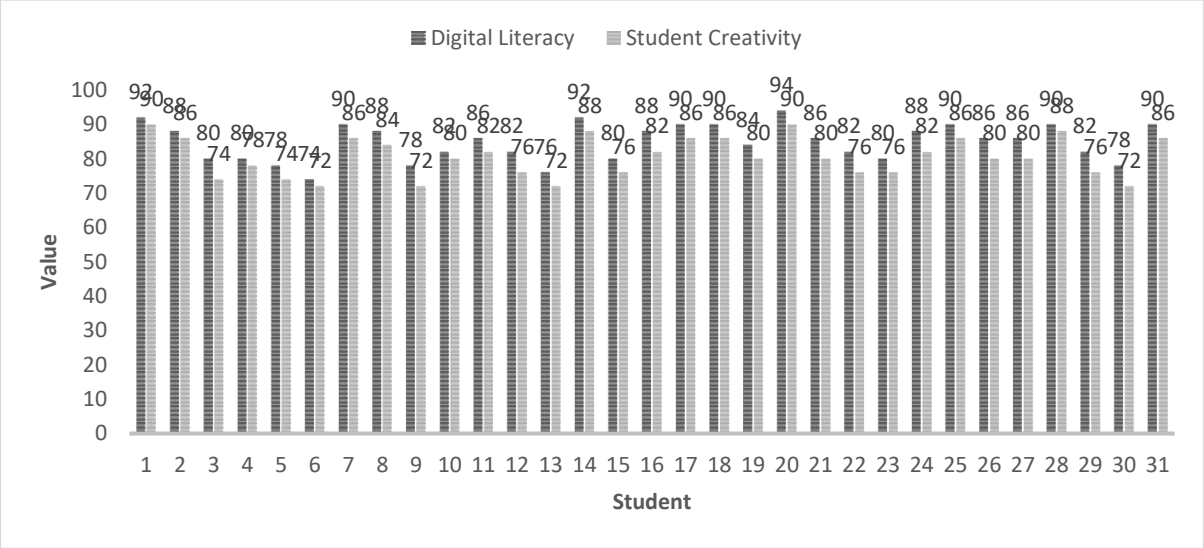

Figure 6. Diagram of Digital Literacy Values and Student Creativity

The implementation of the PjBL model in hybrid mode provides space for students to explore ideas and complete projects independently or collaboratively. In this process, the lecturer only acts as a facilitator who provides initial direction and assistance at critical moments. Students are given the freedom to conduct online group discussions at SPADA UNRAM and the freedom to create innovative ppts, as well as manage work time. This freedom turns out to be one of the main factors that encourages the emergence of creativity, because students feel they have full control over their learning (Cahyani et al., 2024). On the other hand, learning in hybrid mode also encourages students to optimize the use of digital platforms such as Learning Management System (LMS), Google Workspace, Canva, and video editing applications. Students learn how to access valid digital sources, organize information, and present content in an attractive and easy-to-understand digital format. This activity directly strengthens students' digital literacy as a provision for 21st-century learning (Mufaridah et al., 2024).

The results of this study support the findings of several previous studies stating that PjBL can significantly improve students' digital literacy and creativity, especially when implemented in a flexible and technology-based learning environment. In a hybrid context, students have more time to think, access digital learning resources, and discuss their ideas online, which ultimately enriches the quality of the resulting projects (Panjaitan et al., 2020). However, there were also some challenges found during the implementation of the research. Several students admitted to having difficulty in time management and task division in group discussion activities at SPADA UNRAM, especially when communicating online. In addition, not all students have adequate personal digital devices, so some projects are carried out by borrowing devices or relying on campus facilities. This shows that although digital literacy and creativity have increased, there are still external supporting factors that need to be considered to optimize learning (Mastoah et al., 2022).

Another important discussion is the mutually reinforcing relationship between digital literacy and student creativity. Students who have a high level of digital literacy tend to be more able to express their creative ideas into innovative and interesting projects. Conversely, creative students are more motivated to find out and try new digital technologies to support their work. This dynamic interaction shows the importance of developing both competencies in an integrated manner in learning design (Budiman et al., 2021). Overall, this study shows that the implementation of Project Based Learning in hybrid lectures is effective in developing digital literacy and fostering student creativity. This model allows students to experience meaningful learning through product creation, collaborative work, and technology exploration.

Lecturers and higher education institutions need to continue to develop this approach with the support of adequate digital infrastructure and basic digital skills training for students (Dinata, 2021).

With these results, it is recommended that PjBL in hybrid mode be used as the main learning model or strategic alternative in practical or project-based courses. In addition, further research is needed with an experimental approach to test the relationship and influence between digital literacy, creativity, and learning outcomes in more depth. The mixed methods approach can also be used to gain a more comprehensive understanding of the ongoing learning process (Restu et al., 2023).

CONCLUSION

This study shows that lectures with a hybrid mode that implements the Project Based Learning (PjBL) model can provide a positive contribution to the development of digital literacy and creativity of 2nd semester students in the Physics Education Study Program. The results of the descriptive analysis show that most students have a high level of digital literacy and creativity, with a small number in the very high and moderate categories. The project-based learning process allows students to express their ideas more freely, design digital products in the form of powerpoints, and collaborate in groups synchronously and asynchronously. The hybrid mode also provides flexibility of time and space that supports independent and collaborative learning processes, and encourages students to use various digital devices and platforms effectively. The results of student project documentation show that they are able to produce works that are not only innovative but also relevant to the learning context. The close relationship between digital literacy and creativity is clearly seen in the products produced, indicating that mastery of digital technology supports the development of students' creative ideas. However, there are several obstacles faced, such as limited digital devices, gaps in time management skills, and communication barriers in online group work. These factors need attention so that hybrid learning can take place more optimally and evenly for all students.

RECOMMENDATION

The recommendations that the author can convey are: First, Continuous integration of the PjBL model in hybrid mode is recommended to be applied to other courses in the Physics Education Study Program, especially those that require the application of concepts in the form of real projects or products. Second, Improvement of digital infrastructure, such as stable internet access, supporting devices, and user-friendly LMS, needs to be provided by institutions to ensure the success of the implementation of hybrid learning. Third, Basic digital literacy skills training for students and lecturers is very important, so that they are able to utilize technology optimally to support an innovative and effective learning process. Fourth, Mentoring in project management and group work needs to be provided to students, especially in terms of task division, online communication, and time management so that collaborative work runs more efficiently. Fifth, Further research is recommended to examine the relationship between creativity, digital literacy, and learning outcomes quantitatively with an experimental approach. With the support of adaptive and technology-based learning policies, the development of digital literacy and student creativity in this era of digital transformation will be increasingly optimal, supporting their readiness as prospective educators who are innovative and responsive to changes in the times.

ACKNOWLEDGMENT

The author would like to thank the University of Mataram for providing funds to carry out this research through the PNBP FKIP funding source, University of Mataram for the 2025 budget year. The research grant in question is the Capacity Building Research Scheme Research Grant. The author would also like to thank all parties who have assisted in the implementation of this research.

AUTHOR CONTRIBUTIONS

Conceptualization, H. and B.A.; methodology, M.S.; software, D.F.; validation, H., B.A. and M.S.; formal analysis, H.; investigation, H. and M.S.; resources, B.A. and L.M.; data curation, H. and D.F.; writing—original draft preparation, H.; writing—review and editing, B.A. and D.F.; visualization, H. and L.M.; supervision, D.F.; project administration, L.M.; funding acquisition, H. All authors have read and agreed to the published version of the manuscript.

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