Project based learning model in digital literacy course in education to improve creativity of PGSD UNJA students in writing scientific articles

Eka Sastrawati [1] **, Maryono** [1*] **, Yantoro** [1] **, Destrinelly** [1]

[1] Universitas Jambi, Jambi, Indonesia, 36361

Article info	Abstract
	This study aimed to improve students' creativity in writing scientific articles by applying the project-based Learning (PjBL) model. This type of research is classroom action research with four stages: planning, implementation, observation, and reflection. The research instrument used an observation sheet and a questionnaire for writing article creativity. Observations were carried out during learning, and a creativity questionnaire was given at the end of each cycle. Based on the study's results, it was obtained in cycle one that the indicator of fluent thinking creativity was 27% with a lesser category, cycle II 50% with a lesser category, and cycle II 75% with a good category. Then, the flexible thinking indicator in cycle 1 was 34% with a less category, cycle II 60% with a good category, and cycle III 71% with a good category. The original thinking indicator in cycle 1 was 28% with a less category, cycle II 62% with a good category, and cycle III 71% with a good category. The elaborative thinking indicator in cycle 1 was 33% with a less category, cycle II 63% with a good category, and cycle III 72% with a good category.

1. Introduction

Outcome Based Education (OBE), as a mandate from the Ministry of Education at the higher education level, requires a strategy for its implementation. One of the learning strategies to achieve outcomes can be project-based Learning (Project-Based Learning) and problem-based Learning (PBL). Project- and problem-based learning are expected to shape students' competencies and characters to create a unity of learning outcomes. Several applications of project learning (Hizqiyah et al., 2023) ; (Sudarmin et al., 2021) conclude the need for integration and adjustment with methods

or tactics as strategies and student needs. Especially in higher education, the expected achievement is that students can develop themselves from their competencies according to their field of knowledge and apply them to society's needs.

The results of previous studies obtained data in 2023/2024, especially in the digital literacy education course, using projects as a lecture model. However, there are several shortcomings, namely, the projects produced have not significantly impacted students' reasoning competencies, critical thinking skills, and creativity. The produced learning project involved students writing scientific articles with predetermined topics. The results of the reflection of the teaching team show that students' skills in compiling ideas and novelty from the topic of writing scientific articles are still low. Based on the results of observations made on 20 articles written by students, they did not use reference management software and even found that several paragraphs and sentences quoted were still indicated as plagiarism. Students quote several sentences without paraphrasing, which causes problems for students when completing their final assignments. One of the causes of the above problems is that students do not have special ICT Literacy skills, such as using Mendeley software in citing and using various journal web sources to find relevant articles to be used as reference sources in writing final assignments to write scientific articles.

It is concluded that there is a need for a strategy to design lectures that can improve the achievement of lecture outputs in the scope of OBE. Several studies (Hizqiyah et al., 2023; Istikomayanti et al., 2023) state the importance of the aspect of student involvement, especially student sensitivity and concern for problems so that they can produce solutions in the form of project activities or products. One of the efforts to improve the need for achievement of writing competency of prospective teacher students is through digital literacy courses in education. The Digital Literacy course is a general compulsory course (MKWU) for all students of Jambi University, and it is presented in the second year of lectures. This course equips students with an understanding of the digital world, such as the wise use of the internet and social media, finding and filtering information, implementing technology for the world of education, utilizing software for scientific papers, using applications to support fields of study, creating technology-based content, application of programming languages, and using technology for project collaboration. Activities carried out during learning include practice, discussion, presentation, individual assignments, and final project collaboration. A preliminary analysis of students of educational digital literacy courses stated that digital literacy competency could not be avoided during massive information spread due to rapid technological developments. Given that, almost all human activities currently rely on digital technology. Many of them do not know what they can do to ward off hoaxes in this digital era. Only a few stated that having a wise and critical attitude is necessary when consuming information on social media and not easily believing information circulating on digital media.

Gilster (Suherdi, 2021:113) said four competencies must be possessed to be said to be digitally literate as follows. This relates to the ability to search for information data via the internet using a search engine and carrying out activities. Second, hypertext guidance means understanding navigation or guidance in a web browser, how the web works, and the characteristics of web pages. Third, evaluation of information content. It relates to a person's ability to think critically and provide assessments of information found online, which is accompanied by the ability to identify the validity and completeness of the information. This competency is properly compiling knowledge and collecting and evaluating facts and opinions from online information. Students should consider these four things as the digital generation. Not just searching for information from one source and then processing it into new knowledge. Critical thinking skills are needed to analyze and compare to validate the information obtained.

In classroom learning activities, students need this competency to support learning, such as when writing opinion articles and scientific papers and using e-resources. However, a study by

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Nurjanah, The Relationship between Digital Literacy and the Quality of E-Resource Use, found that high digital literacy skills do not guarantee that high-quality e-resource use can be achieved. Therefore, in order to obtain high-quality e-resource use, more complex digital literacy skills are needed. Writing scientific articles is one of the teaching materials given to third-semester students of the elementary school teacher education study program (PGSD) FKIP Universitas Jambi. By writing scientific articles, students are expected to respond to problems in society critically, contribute to finding solutions to them, and, at the same time, build empathy for the situation that occurs. However, students face various obstacles in writing, including low ability to express ideas and low use of references when writing articles.

A scientific article is an article that contains and examines a particular problem using scientific principles. Scientific principles mean that scientific articles use scientific methods in discussing problems, present their studies in standard language and scientific writing, and use other scientific principles: objective, logical, empirical (based on facts), systematic, straightforward, clear, and consistent. Writing scientific articles is essentially part of scientific activities as a whole. (Wasmana, 2011) . As an implication, knowledge is always sought and pursued through research because the basic value applies to scientists and everyone concerned with seeking the truth. The next implication is that the research results must be disseminated publicly. A scientific article is a specialized type of written work that focuses on investigating and analyzing a specific problem or issue through the lens of scientific principles. These principles refer to the systematic and methodical approaches used in scientific inquiry, ensuring the article adheres to a framework grounded in evidence and objectivity. Scientific articles are distinguished by their reliance on the scientific method to explore questions, which involves carefully collecting, analyzing, and interpreting data to conclude.

Writing scientific articles is one of the basic skills that every lecturer and student in higher education must possess. This ability is the main window to develop scientific insight with scientific thinking methods. The nature and consequences of writing scientific articles are the ability to solve and analyze several problems based on good and correct scientific writing methods. One of the major obstacles lecturers and students face is the still low culture of writing scientific articles and scientific research publication manuscripts. Although it is said to have increased in quantity, the quality is generally unsatisfactory. This phenomenon can be seen in several final research results whose contribution in the form of scientific research manuscripts for publication has not been optimized. Another problem that is also quite concerning is the still low interest of lecturers and students in scientific writing in general (Nuryani Tri Rahayu, Joko Suryono, 2023)

As mentioned earlier, scientific articles require references. The existence of these references strengthens the argument of the article writer so that it can influence readers on the truth conveyed by the article writer. For that, a reliable source of information is needed. In the current technological era, sources of information can be obtained from the internet. However, digital literacy skills are needed to account for the information sources. Research related to digital literacy has been widely studied. It is said (Joyo, 2019) that computer and network engineering students can master five aspects of digital literacy: accessing, analyzing, evaluating, creating, reflecting, and acting and processing readings about local wisdom to communicate with others. Another study written by (Nudiati and Sudiapermana, 2020) entitled Literacy as a 21st Century Life Skill In is known to be quite high at 7.1%. Unfortunately, it is still relatively difficult to obtain information from trusted sources. Research on applying the *project-based learning model* to write scientific articles has also been carried out by many researchers, including (Safitri Yulandari et al., 2024) .

Based on the explanation above, the author is interested in examining the application of the *project-based learning model* in the digital literacy education course to improve the creativity of UNJA PGSD students in writing scientific articles. The formulation in this study is applying the

project-based learning model in the digital literacy education course to improve the creativity of UNJA PGSD students in writing scientific articles. Referring to the formulation of the problem, the purpose of this writing is to describe the application of the *project-based learning model* in the digital literacy education course to improve the creativity of UNJA PGSD students in writing scientific articles. Then, the urgency of the research is to maximize the use of technology to improve digital literacy skills in writing scientific articles to face the industrial era 4.0. This research is hoped to be used as a reference in learning to write scientific articles, especially for students. Thus, the obstacles in writing scientific articles that students originally experienced can be avoided.

2. **Method**

This research is a classroom action research (*classroom action research). Action research*). *Action Research* is an activity or action of improvement from planning, implementation, and evaluation carried out in a structured manner so that its validity and reliability reach the research level. This structured approach allows for a clear and coherent cycle of improvement, where researchers (in this case, the educators) continuously refine their practices based on the results obtained. Furthermore, Action Research is not merely a passive observation but a hands-on, active process to address specific problems or challenges within the classroom environment. *Action Research* can also be interpreted as a research system for solving a problem involving interaction between researchers and clients in achieving research objectives (Cohen et al., 2017). t can be understood as a research system specifically designed to solve practical issues, with a key characteristic being the collaboration and interaction between researchers and participants (the clients, typically students in this case).

The subjects in this study were 156 Semester III (Odd) students of the Elementary Teacher Education Program, Teacher Training and Education Faculty, Jambi University, in the 2023/2024 academic year who took the digital literacy course in education. The research instrument used an observation sheet to observe students' creativity in compiling scientific articles, questionnaires, and documentation of student activities. Meanwhile, the data analysis technique used was a qualitative descriptive technique. The project assessment rubric was assessed through three stages, namely 1) the preparation stage, including assessing students' abilities in planning, exploring, developing ideas, and designing scientific article writing products; 2) the product creation stage, including assessing students' abilities in selecting and using tools, materials, and techniques for making scientific articles; 3) the stage of assessing the results of the work; carried out on the work produced by students according to the established criteria including the grid for creativity in writing scientific articles including fluency, flexibility, original thinking and elaborative thinking. This research consists of 3 cycles, and each cycle has three main steps: 1) action plan, 2) implementation of action, and 3) reflection, which includes observation and evaluation.

Stage planning

Planning activity learning will be done at the planning stage, as stated in the RPS developed with the PjBL model. In addition, other learning tools, such as teaching materials and observation sheets, are also prepared to observe student creativity.

Implementation stage

The learning process is implemented using the PjBL model; students work in groups, and the learning stages are by the PjBL syntax, as seen in **Table 1.**

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Table 1. Syntax of the PjBL model for learning assessment courses in elementary schools

No	Syntax	Activity	
		Lecturer	**Student**
1	Determining Fundamental Questions	Providing students with stimulus related to the topic in the form of simple questions that require students to think creatively regarding the solution.	Students examine the questions given by the lecturer by asking questions that help students understand the problem.
2	Designing Project Planning	The lecturer divides students into groups of 4-5 people to complete the project. The lecturer re-explains the learning objectives to be achieved in making this project.	Students listen and start planning the project by dividing the tasks among each team member of the group that has been formed.
3	Making a Schedule	Agree with the student regarding the time to complete the case.	Propose and agree on the completion time of the case scenario with the lecturer.
4	Monitoring Students and Progress Project	Observing progress project completion by students as well as facilitating student If There are things to reflect related settlement projects	Complete the project the lecturer gave through discussion and collecting supporting information to solve the case.
5	Testing Results	Assess the results of projects presented by students based on the indicators tested.	Presenting the results of discussions on projects given by lecturers
6	Evaluating Experience	Evaluate the results of student project work by providing input and reflection on the lecture material.	Receive lecturer input on the reflections given and improve the results of the project work produced.

The syntax or steps of this activity design will be implemented in several meetings during the lecture period. In this educational digital literacy course, researchers will use the PjBL model at meetings 6-7 for cycles 1, 9, and 10 for cycle two and meetings 11 and 12 for cycle 3.

Observation Stage

Action observation is carried out by a team of lecturers on the ongoing learning process in the classroom and to monitor project activities that students will carry out to create scientific articles and documentation during the learning process. Lecturers provide assessments from the initial activities of the learning syntax to the end of learning using creative instruments.

Evaluation and Reflection Stage

This stage is carried out at the end of the learning cycle. The data obtained will be analyzed, and then the conclusions will be made about which aspects need improvement and which parts have achieved the target of getting a score > 71 (B) criteria evaluation results in observing student creativity during the learning process, as in **Table 2** below.

Table 2. Assessment criteria

Category	Percentage (%)
Very good	>81
Good	60 – 80
Not enough	40-59
Very less	< 39

3.   Results and Discussion

Based on the characteristics of cyclical classroom action research (CAR), this research was conducted in three cycles, referring to the research objective, namely, to improve students' creativity in writing scientific articles. In each cycle, four stages of CAR were carried out. In the initial stage, namely planning, what was done was to prepare learning tools (RPS based on PjBL in the digital literacy course of education, LKM, media, and assessment) and pay attention to students' learning conditions. The hope is that the next stage will be more optimal, and then the implementation and observation stages will be carried out simultaneously. What is done is to carry out learning in the classroom by referring to the tools used in the previous stage and simultaneously conducting observations and assessments. 2 observers assist in observations. At the reflection stage, namely analyzing the results obtained at the end of each cycle, this reflection aims to evaluate the success or failure of learning activities and find solutions to problems that arise during learning activities. The following is a presentation of students' creativity in writing articles.

Table 3. Student creativity in writing articles

Indicator	Cycle 1		Cycle II		Cycle III	
	Percentage	Category	Percentage	Category	Percentage	Category
Fluent Thinking	27	Very less	50	Not enough	75	Good
Flexible Thinking	34	Very less	60	Good	71	Good
Think Original	28	Very less	62	Good	71	Good
Elaborative Thinking	33	Very less	63	Good	72	Good

Based on the data in the table, there is an increase in each creativity indicator observed from cycle I to cycle III. The detailed presentation of the results of the creativity indicators is as follows:

Fluent Thinking Ability

Fluent thinking is one of the indicators of creativity, which is characterized by the ability to find ideas or concepts and generate many ideas to solve problems. It also includes providing various ways or suggestions for completing various tasks. Students with fluent thinking skills can usually provide many solutions, have various ideas for a problem, and are fluent in conveying their ideas (Fatmawati et al., 2022) .

The table above shows that in cycle I, students' fluent thinking ability is in the poor category, with a percentage of 27%. The reflection results show that in cycle I, students could not express their ideas during lectures. Many students are still indifferent to the learning process with the PjBL model. In addition, some students seem unfocused, such as playing with their cell phones while learning. The most striking deficiency is the lack of group cooperation when completing the project.

Based on the reflection results, in cycle II, the lecturer improved learning by increasing motivation at the beginning of the lecture. It was done by showing a PowerPoint presentation analyzing articles relevant to educational digital literacy material and linking them to the problem topics that will be made into articles. In addition, the lecturer also emphasized the importance of student skills in finding good articles to cite. This improvement significantly positively impacted student learning activities in cycle II, which was 50%. Students begin to be able to express their ideas or thoughts during learning. Many students do not understand what scientific articles and scientific reports are, and they are less able to describe the differences between scientific articles and scientific reports; in cycle II, they already understand how to write scientific articles and can explain the form of scientific article reports based on experience and expert opinions.

In cycle II, lecturers continued to motivate students and increased monitoring during the project work. In the PjBL model, monitoring the project work process is a priority, not just assessing

the final results. This focus on the learning process significantly impacted cycle III, where 75% of students could express their ideas and concepts. In addition, students became more fluent in asking questions and conveying arguments or ideas. The results of this study are consistent with the findings of (Susanti et al., 2022) , which states that teacher motivation in project-based Learning (PjBL) helps students reflect on their ideas and opinions, which impacts the overall learning outcomes.

Flexible Thinking

The second indicator of creativity learning is flexible thinking skills. This skill refers to generating new or varied answers and questions and seeing a problem from various perspectives. Students with flexible thinking skills are shown by their ability to provide new questions, diverse answers, and various interpretations of a story or problem (Dwivedi et al., 2023; Knott et al., 2022) . Based on Table 2, in cycle I, students' abilities in this indicator were still in the poor category with a percentage of 34%. However, this ability increased in cycles II and III, reaching 60% and 71%, respectively, which were included in the poor and good categories. The reflection results showed that although there was an increase, some students could still not provide varied answers related to project problems. This is due to the tendency of students to focus on their friends' answers without exploring their potential and ideas.

In addition, it is seen that the PjBL syntax has not been implemented optimally, especially during the testing of *the results*. There are no new questions given, and the questions used are only repeating from the previous group. To overcome this, the lecturer made several improvements, such as helping students explore more varied answers and questions and being more consistent in applying the PjBL model. At this stage, the lecturer gives specific directions on the fifth syntax, namely *testing the results*, by encouraging students to see various points of view based on the results presented by the presenter group. For example, students are invited to observe the article's introduction, the selection of the type of research design, and compile research instruments. (Tyng et al., 2017) stated that by observing objects directly and carefully and reasoning about them, the brain will process the information so that students can ask responsive questions as part of flexible thinking skills. Through this stimulation, students can produce more varied questions and answers during the presentation session.

Think Original

Original thinking skills are the ability to generate new ideas and create unusual combinations of elements. Students with original thinking skills tend to think of things that others have not thought of, question old ways, try to find new ways, and work together to create innovative adjustments (Verhoef et al., 2021) .

Based on Table 2, in cycle I, students' original thinking ability was still in the poor category with a percentage of 28%. However, there was an increase in cycles II and III, where this ability reached the good category with percentages of 62% and 71%, respectively. The reflection results showed that in cycle I, students still had difficulty producing innovations in article topics to be developed, so their original thinking ability had not developed optimally.

The improvements made by the lecturer were to provide instructions on how to find better research novelties in cycles II and III to stimulate innovative thinking. While in cycle I, the teacher only used PPT. Furthermore, in cycles II and III, the lecturer added media in the form of AI combined with demonstration methods to improve students' mastery of concepts. In addition, the lecturer also added stimulus in terms of providing innovative ideas from their assignments. After receiving stimulus, students were able to find innovation in their projects based on the results of group work

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discussions. It can be seen from the projects worked. Many of the article topics produced result from students' innovative thinking.

There are 25 articles written by students related to digital literacy have been submitted to various Sinta 4 and Sinta 5 journals. As many as eight articles were accepted for publication in Sinta 4, and 10 were accepted in Sinta 5. The rest are still being reviewed. (Karunarathne & Calma, 2024) Moreover, (Lee & Lee, 2023) , said that original thinking is part of a person's ability to produce a product that is different from others or can be creative. A creation is the result of human thought or intelligence. In line with this study, (Misbah et al., 2024) , and (Suryaningsih et al., 2024) , also concluded that PjBL can improve students' mastery of teaching materials on concepts that impact students' original thinking. With good mastery of concepts, students will be sharper in thinking and able to produce innovative works.

Elaboration Skills

Elaboration skills refer to the ability to detail something systematically and provide in-depth answers to questions. Students who have this skill can describe information in detail and a structured manner and provide advice that can be explained both to themselves and others (Gomes et al., 2023; Nurfuadi et al., 2023)

In cycle I, this indicator was in the very poor category with a percentage of only 33%, but slowly increased to a good category in cycle II and reached a good category in cycle III. The results of the reflection showed that in the syntax of the assessment results, the shortcomings in cycle I were that students had not been able to systematically explain the stages of the data collection method. This was caused by differences in views between group members who were still based on their respective arguments. Therefore, in cycles II and III, lecturers improved the learning process to improve students' understanding and skills.

The improvements made involve strengthening the concepts being studied. One example is the selection of topics, research approaches, data processing and analysis, utilization of references and scientific sources, compilation and writing style, and innovation in presentation and visualization. This approach aims to motivate students to understand the concepts in the projects they develop better. As a result, in cycles II and III, students can systematically detail the projects they are working on in terms of preparation and compiling articles and publications.

In this case, students can explain in detail how to make a project to compile a scientific article along with its benefits and detailing the stages of project development using their language. This finding aligns with research (Widana & Handayani, 2022) , which states that PjBL can increase students' learning motivation and strengthen their mastery of concepts. With good learning motivation, understanding of concepts will also increase. This allows students to think more creatively, which in turn helps them complete project designs in the way they choose.

Based on the table above, it can be concluded that students' creativity in writing articles has increased from cycle I to cycle III. It shows that the PjBL learning model effectively increases students' creativity in writing articles. The consistency in lecturers' continuous model application also supports this increase. In other words, the PjBL learning syntax is applied sequentially and systematically, making the learning process more focused and positively impacting student learning outcomes.

4. Conclusion and Implications

Based on the results and discussions that have been carried out, it can be concluded that the PjBL learning model can improve students' creativity in writing articles in the Elementary School

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Teacher Education Program at Jambi University. The next recommendation is that further research needs to be carried out by implementing PjBL, which is integrated with learning approaches such as Contextual Teaching Learning (CTL) or with inquiry.

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