

Scientific Article Review Project in Professional Education Lectures: Developing the Competence of Prospective High School Physics Teachers with the Project-Based Learning Model

Hikmawati^{1*}, Ahmad Busyairi¹, Nina Nisrina¹

¹ Physics Education Study Program, University of Mataram, Mataram, Indonesia.

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Abstract: The application of the Project-Based Learning (PjBL) model in the Education Profession course aims to develop the competence of prospective high school physics teacher students. This study uses a case study design with 28 class IIA students in the even semester of 2024 in the Physics Education Study Program, FKIP, University of Mataram as subjects. Data were obtained through a learning outcome test in the form of 10 descriptive questions which were analyzed to see individual and classical completeness. Individual completeness is achieved if the student's score is above 75.0 and classical completeness is achieved if 85% of students get a score above 75.0. The results of the study showed an average score of 85.2 with 100% of students meeting the individual and classical completeness criteria. These findings indicate that PjBL is effective in improving the competence of prospective physics teacher students through scientific article review activities. In other words, student competencies have been successfully developed through the application of the PjBL model. The scientific article review project has developed critical and analytical thinking skills needed by students to support 21st century learning. The implementation of PjBL in this course is not only relevant to the vision of the Physics Education Study Program to produce professional graduates, but also supports the achievement of national education goals. This study recommends the implementation of PjBL in other courses and the development of further research related to its effectiveness in improving the innovative skills of prospective teacher students.

Keywords: Article review, Project-Based Learning, teacher competence.

Introduction

In the world of education, the quality of teachers plays a very important role in achieving national education goals. Teachers are not only tasked with conveying knowledge, but also shaping the character and skills of students (Ahmad Busyairi, Harjono, Ardhuha, et al., 2022). Therefore, the quality of education is highly dependent on the competence of teachers who are able to integrate knowledge, skills, and attitudes in the learning process. To ensure that prospective teachers can meet the expected competency standards, higher education must provide programs

that can develop their abilities in various aspects (Jihannita et al., 2023). One way that is done by the Physics Education Study Program, FKIP, University of Mataram is through the Education Profession course, which aims to develop the competence of prospective professional high school physics teachers.

The Physics Education Study Program at FKIP, University of Mataram has a vision to produce graduates who are competent in the field of physics education, have good pedagogical skills, and are able to adapt to developments in science and technology. The Education Profession course in the Physics Education Study Program not only emphasizes mastery of teaching materials, but also skills in designing and

Email: hikmawati@unram.ac.id

implementing effective learning. This vision is in line with the mission to produce professional high school physics teachers who are ready to face the challenges of future education (Hujatusnaini et al., 2022).

The Teaching Profession course taken in semester 2 by Physics Education Study Program students is one of the means to equip prospective teachers with the competencies needed to carry out their profession. One of the important components in this course is a scientific article review project that aims to develop students' abilities in assessing, analyzing, and conveying ideas contained in scientific articles related to physics education. This activity aims to improve students' critical and analytical thinking skills, as well as introduce them to scientific processes that are relevant to the world of education (Mursid et al., 2022).

Reviewing scientific articles in national journals is part of the Project-Based Learning (PjBL) learning model applied in the Teaching Profession course. PjBL is a learning model that focuses on solving real problems through projects that are relevant to the world of education (Rahayu et al., 2023). In this case, the scientific article review project provides students with the opportunity to be directly involved in scientific activities that develop the skills needed to become professional teachers (Zain et al., 2022). This project also supports the development of competencies that are not only limited to mastery of teaching materials, but also to the ability to think critically, solve problems, and communicate effectively (Lim et al., 2023).

The Project-Based Learning (PjBL) model has clear stages to ensure that the learning process runs effectively. The first step in PjBL is determining basic questions, where students are invited to formulate the main questions that are the focus of their projects. In the context of reviewing scientific articles, these questions can be related to the problems raised in the article or how the article can be applied in the context of physics education in high school (Hikmawati & Suastra, 2022).

The second step is to prepare a project plan, where students plan the steps to be taken in their review project. At this stage, students select scientific articles that are in accordance with the specified topic and plan the analysis methods to be used. This plan also includes identifying other relevant sources and strategies for obtaining additional information that can enrich their study (Suradika et al., 2023).

The third step is to create a schedule, which aims to plan the time needed for each stage of the project. With a clear schedule, students can manage their time effectively, from reading and analyzing scientific articles, writing reports, to preparing presentations.

This scheduling also helps students to stay focused on project goals and meet predetermined deadlines (Asman et al., 2022).

The fourth step is monitoring, where lecturers or course instructors monitor the progress of the projects worked on by students. At this stage, students are given feedback regarding the progress of their projects, so that they can make improvements and refinements before reaching the final results. This monitoring aims to ensure that students remain on the right track in completing the project and understand the related concepts (Umar & Ko, 2022).

The fifth step is testing the results, where students test their findings and analysis against the selected scientific articles. At this stage, students hold discussions with lecturers and fellow students to ensure that the understanding obtained is in accordance with academic standards. Students can consider the feedback given to improve the quality of their review results, as well as prepare better presentations. The final step is the evaluation of the experience, where students reflect on the experience they have gained during the project. This evaluation includes an assessment of the work process, challenges faced, and the results achieved. Students are expected to be able to identify strengths and weaknesses in the projects they have carried out, and how these experiences can be applied in the context of future learning (Hanum et al., 2023).

By implementing the Project-Based Learning model through a scientific article review project, students are expected to be able to develop four main competencies regulated in the Law of the Republic of Indonesia concerning Teachers and Lecturers, namely pedagogical, professional, social, and personality competencies. Pedagogical competencies include teachers' abilities in designing, implementing, and evaluating effective learning processes that are relevant to student characteristics. Professional competencies refer to in-depth mastery of teaching materials and the ability to convey materials in a way that is easily understood by students (Hikmawati, Verawati, et al., 2023).

Social competencies are very important in creating harmonious relationships between teachers and students, as well as between teachers and the academic community (Marlina et al., 2024). Teachers who have good social competencies can collaborate with fellow teachers, parents of students, and other parties involved in the world of education (Herlanti et al., 2024). Personality competencies refer to the attitudes, behaviors, and values possessed by teachers that can be examples for students in everyday life. Teachers who have good personalities will be role

models for students and can shape their characters better (Anggereini et al., 2023).

Through the Project-Based Learning model in the Education Profession course, students of the Physics Education Study Program at the FKIP, University of Mataram are expected to not only master theoretical knowledge about physics education, but also have the practical skills needed to become competent teachers (Hikmawati, Ayub, et al., 2023). With the competencies they have, graduates are expected to be able to make significant contributions to the world of education, especially in teaching physics at the high school level. It is also expected that the graduates produced can become professional physics teachers and be able to face the challenges of the world of education in the future (Nuryadin et al., 2024).

Method

This study uses a case study method with a quantitative descriptive approach to explore the implementation of a scientific article review project based on the Project-Based Learning (PjBL) model in the Teaching Profession course (Creswell, 2012). This model was chosen to provide an in-depth description of the process and results of the implementation of PjBL in developing the competencies of prospective physics teacher students at the high school level. The research was conducted at the Physics Education Study Program, FKIP, University of Mataram, for three months, from April to June 2024. The subjects of the study were 28 class IIA students in the even semester of the 2023/2024 academic year who took the course.

The research was conducted through several stages. At the planning stage, the objectives and design of the scientific article review project were determined, PjBL-based learning tools were prepared, and learning outcome test instruments were developed. The implementation stage involves six main stages of the PjBL model, namely determining basic questions, preparing a project plan, preparing a schedule, monitoring the project by lecturers, testing results through presentations, and reflecting on project experiences. Data were collected through a learning outcome test in the form of essay questions to measure students' understanding of the scientific articles being reviewed (Nur Eva Zakiah et al., 2020).

Lectures are conducted online via SPADA UNRAM and Google Meet. Lectures via SPADA UNRAM are shown in Figure 1, while lectures via Google Meet are shown in Figure 2.



Figure 1. Lectures via SPADA UNRAM

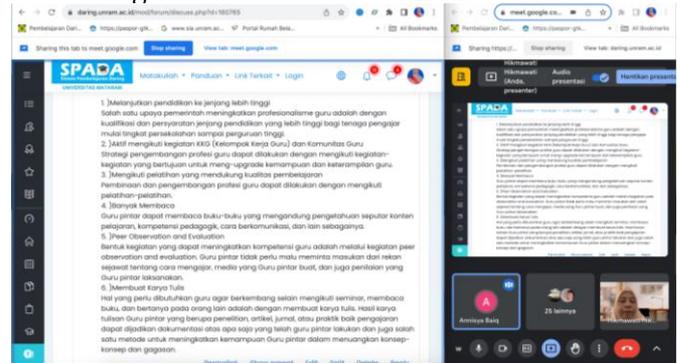


Figure 2. Lectures via Google Meet

The research instruments included a learning outcome test and a project monitoring guide. Individual completion was calculated based on students who obtained a score of more than 75, while classical completion was achieved if more than 85% of students achieved that score. Data analysis was carried out descriptively to determine the average score, maximum score, and minimum score, as well as to calculate the percentage of individual and classical completion.

Result and Discussion

The results of the study showed that all 28 students of class IIA Physics Education Study Program, FKIP, University of Mataram achieved individual completeness in learning outcomes. The highest score achieved was 90.5, while the lowest score was 76, with an average score of 85.2. Individual completeness was determined by the minimum score criteria of 75, so that no students failed to meet this standard. These results indicate that the implementation of the Project-Based Learning model has developed student competencies in the Education Profession course. Student learning outcomes are shown in Figure 3.

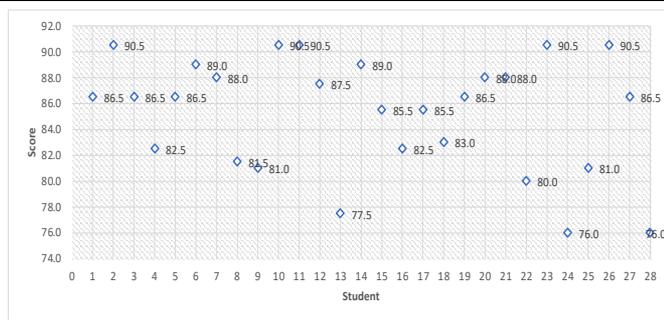


Figure 3. Student learning outcome.

Classical completeness, which requires at least 85% of students to achieve a score above the minimum completeness criteria, was also achieved with a percentage of 100%. This shows the success of the implementation of PjBL as an innovative model that supports active and collaborative learning. This completeness is an indicator that the majority of students not only understand the material conceptually but are also able to apply the concept in real project analysis, namely scientific article reviews. Thus, project-based learning makes a real contribution to encouraging the achievement of student competencies holistically.

The success of students in meeting individual and classical learning completion shows a strengthening in mastery of pedagogical and professional competencies, which are two of the four main competencies of professional teachers in accordance with Law No. 14 of 2005 concerning Teachers and Lecturers. Pedagogical competence is seen from students' ability to understand basic concepts of physics education and relate them to the implementation of learning in schools (A Busyairi & Verawati, NNSP, 2022). Meanwhile, professional competence is seen in their ability to analyze the contents of scientific articles and integrate these findings into scientific-based learning designs (Preston, 2021).

The project-based learning model applied is based on a constructivist approach, where students build their knowledge through an inquiry process and active exploration of real problems (Fitri et al., 2024). The constructivist-based learning process allows students to develop deep conceptual understanding through direct interaction with projects that are relevant to real life (Mulyani et al., 2023). In this study, the scientific article review project was designed to train students to think critically, evaluate information, and construct evidence-based arguments, which are essential competencies for prospective physics teachers at the high school level (Singh & Meena, 2022).

In addition, PjBL provides opportunities for students to develop Higher Order Thinking Skills

(HOTS) which include analysis, evaluation, and creation (Hikmawati et al., 2022; Krathwohl, 2017). These skills are essential in learning based on the Independent Curriculum, which emphasizes independent learning and is oriented towards problem solving. The scientific article review project places students as active subjects who are responsible for their own learning process (Astalini et al., 2023).

The success of learning is also inseparable from the role of lecturers as facilitators who guide students in every stage of the project (Launuru et al., 2021). The success of PjBL is highly dependent on relevant project design and optimal mentoring support. In this study, lecturers provide clear directions on how to review scientific articles, prepare reports, and present results. This creates a conducive learning environment, where students can develop according to their respective potentials (Amin et al., 2023).

The results of the study also showed that project-based learning has a positive impact on the development of students' social skills (Pantiwati et al., 2023). Through group discussions and presentations of project results, students learn to work together, communicate effectively, and respect the opinions of others. Social interaction in learning allows students to build knowledge collectively, which ultimately improves their ability to work in teams, a skill that is very important for a teacher (Nuraini et al., 2023).

The positive impact of PjBL on learning outcomes is in line with previous studies showing that this learning model can increase student engagement and motivation (Hikmawati, 2022). When students are faced with challenging projects, they feel more motivated to learn because the project has direct relevance to the real world (Yustina et al., 2020). In the context of this research, the scientific article review project not only helps students develop analytical skills but also provides insights into how to use research to support classroom learning.

Project-based learning also contributes to preparing students to become adaptive and innovative teachers (N. E. Zakiah & Fajriadi, 2020). In the era of modern education, teachers are required to be able to design learning that is interesting and relevant to students' needs. With the experience of completing projects collaboratively, students not only understand the material conceptually but also learn how to apply the concept in real situations (Ahmad Busyairi, Harjono, Hikmawati, et al., 2022). This is an important provision for them to face the complex challenges of 21st-century learning (Sudatha & Agung, 2022).

Conclusion

This study concludes that the implementation of the Project-Based Learning model has succeeded in developing the competency of prospective physics teacher students in the Education Profession course. The results of the study showed that all students achieved individual and classical completion with an average score of 85.2. This reflects the success of PjBL in integrating theory and practice, while encouraging mastery of pedagogical, professional, social, and personality competencies that are important for professional teachers. In addition, this model also helps students develop Higher Order Thinking Skills (HOTS) and collaborative skills that are relevant to the demands of the Merdeka Curriculum and 21st century learning.

Based on these findings, it is recommended that the Project-Based Learning model be applied more widely in courses in physics education study programs, especially those oriented towards developing students' practical and analytical skills. Further research is also recommended to explore the effectiveness of PjBL in improving other aspects, such as students' creativity and adaptability, in order to prepare them to become innovative physics teachers at the high school level and competent in facing the challenges of a dynamic world of education.

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