Implementing Project Based Learning in Optical Physics Course: Students' Perceptions

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Abstract. This study examines how students perceive the implementation of the project-based learning model in circle material and how they perceive the performance of the project-based learning model in Optical Physics for Optic Refraction students. The participants in this study were fifty pupils. This sort of research is quantitatively descriptive and employs a survey research design. The results of this study indicated that project-based learning and instructional materials can improve active learning and engage learners. Students can increase their communication and responsibility by cooperating with peers on project-based learning activities. Students believe they can readily understand project-based learning subjects with online self-study materials. This study suggests that project-based learning materials can be used to teach optical physics.

Keywords: Project Based Learning · Optical Physics · Students' perceptions

1 Introduction

One reason students don't understand learning materials well is that the way the teacher teaches does not involve the students in the learning process. So, we need new ways of learning that can get students more interested and creative about learning. Project-based learning (PjBL) is a way to learn that can help you get around these problems [1]–[3].

PjBL is a way of learning that emphasizes learning in real-world situations through complex activities [4]. This is in line with the ideas behind project-based learning, which are: first, learning should be centred on the learner and involve real-world tasks; second, project assignments should focus on research activities based on themes that have already been decided; and third, the investigation should be done in a real way and lead to a real product. The work's products, reports, or results are then shared to get responses and feedback that can be used to improve the next project [3].

Most students can only understand by definition, so it's easy for them to forget what the material is really about. Students can build and combine experience, knowledge, and direct observation through project activities like preparing tools and materials, designing experiments, running experiments, making observations, analysing data, and drawing their own conclusions. They can also share the results of their experiments through presentations.

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The teacher must evaluate at least three things in project-based learning: cognitive assessment, projects, and products. At least three things need to be taken into account when judging a project: the student's ability to choose a topic, find information, and manage time to collect data and write a report; the project's relevance to the subject matter, taking into account the student's level of knowledge, understanding, and skills; and the project's originality, which means that it must be the result of the student's own work.

Project-based learning model makes learning more fun. During the two project activities, students have shown that they can do what they must. This is shown by getting scores that are above average. In general, each group has been able to come up with a project on their own. This is because they have the right skills for using ICT, making tools and materials, using tools and materials, making observations and analysing data, writing reports, and presenting observational data. While product assessment (evaluation) includes evaluating what students have made based on set criteria.

Based on the previous studies, the required subject taught in the DIII Optic Refraction (RO) STIKES HAKLI Semarang Study Program is Optic physics, which students dislike and find difficult. This is an additional difficulty in learning Physics, particularly Optical Physics [5]. Optical physics is a branch of physics that investigates the fundamentals of light and its interactions with matter, such as classical optical phenomena such as reflection, etc. [6]. Learning optical physics is required for the Optic Refraction Department Diploma Program at STIKES HAKLI Semarang. This topic is difficult for students to grasp, and they are not engaged in the learning process. Therefore, this study examined the students' perceptions on implementing PjBL in optical physics courses.

2 Method

This sort of research is quantitatively descriptive and employs a survey research design. The research method used for this study was a survey-based quantitative method. The survey consisted of 15 questions that were asked to students in close and close-ended questions. They comprise 4 questions related to learning materials, 7 questions related to implementing the problem-based project-based learning model, and 4 questions about the learning resources used independently in learning project-based learning. The research participants comprised 50 optical refraction students at the Stikes Hakli Semarang. They are 35 were female, and 15 were male. The survey was conducted after the students received 14 meetings of the learning process, 12 meetings of teaching-learning process, and 1 meeting for learning reflection and teachers' feedback. The stages of implementing PjBL in Optical physics course can be seen in Table 1.

Students' products (that can be seen in Fig. 1) after implementing PjBL in optical physic related to the following materials:

a. law of refraction of light
b. image formation in a convex mirror
c. image formation in plane mirrors
d. refraction of light in the lens of the eye

Table 1. Stages in Implementing Project-based learning in Optical Physics instruction

PjBL Stages	Learning activities in Optical Physics instruction
1. Associated issue with daily life	Mitigate the misconceptions about the following topics • law of refraction of light • image formation in a convex mirror • image formation in plane mirrors • refraction of light in the lens of the eye • Formation of shadows on the eye of myopia (near-sightedness)
2. Plan the project	Plan the learning materials related to the topics for creating project including learning instruments
3. Discuss and gather information	Conducting discussion in group to decide the stages in completing the project
4. Develop the learning project	Doing the action for creating the project of making a learning video of doing an experiment to understand the learning topics.
5. Preparing project presentation	Doing presentation and demonstration recording with video recorder and editing the video
6. Dissemination	Uploading the students' works to Their YouTube
7. Reflection and evaluation	Doing reflection by Lecturers and Peer assessment

e. Formation of shadows on the eye of myopia (near-sightedness)

The questionnaire was validated beforehand to 15 students to find out the relative mobility and validity of the items on the questionnaire so that the questionnaire can be ascertained to be valid and used in the research process. The questionnaire shows that. The value is above 0.05. The statistical results of the questionnaire validity based on Pearson Correlations indicate that 15 questionnaire statements out of 20 items had significant scores less than 0.05 levels of significance; thus, 28 valid items were used in the current study. The internal consistency method was used to determine the reliability coefficient of the TPACK questionnaire; the Cronbach's alphas of the questionnaire scale was 0.78.

The ESP teacher questionnaires were distributed after receiving each participant's informed consent. They assure that any data they enter is kept confidential and utilized for research. Each participant required 15 to 20 min to complete the Forms questionnaire. The results were analyzed quantitatively using Microsoft Excel and SPSS 21.

3 Finding and Discussion

This study aims to determine how students view the application of the project-based learning approach in optical physics. Research findings, as seen in Fig. 2 reveal that the first three kinds of findings about the subject matter being taught, whereas the second on is a result of the learner's technique, namely project-based learning. And the last one, a reflection of student perceptions of the utilized instructional tools.

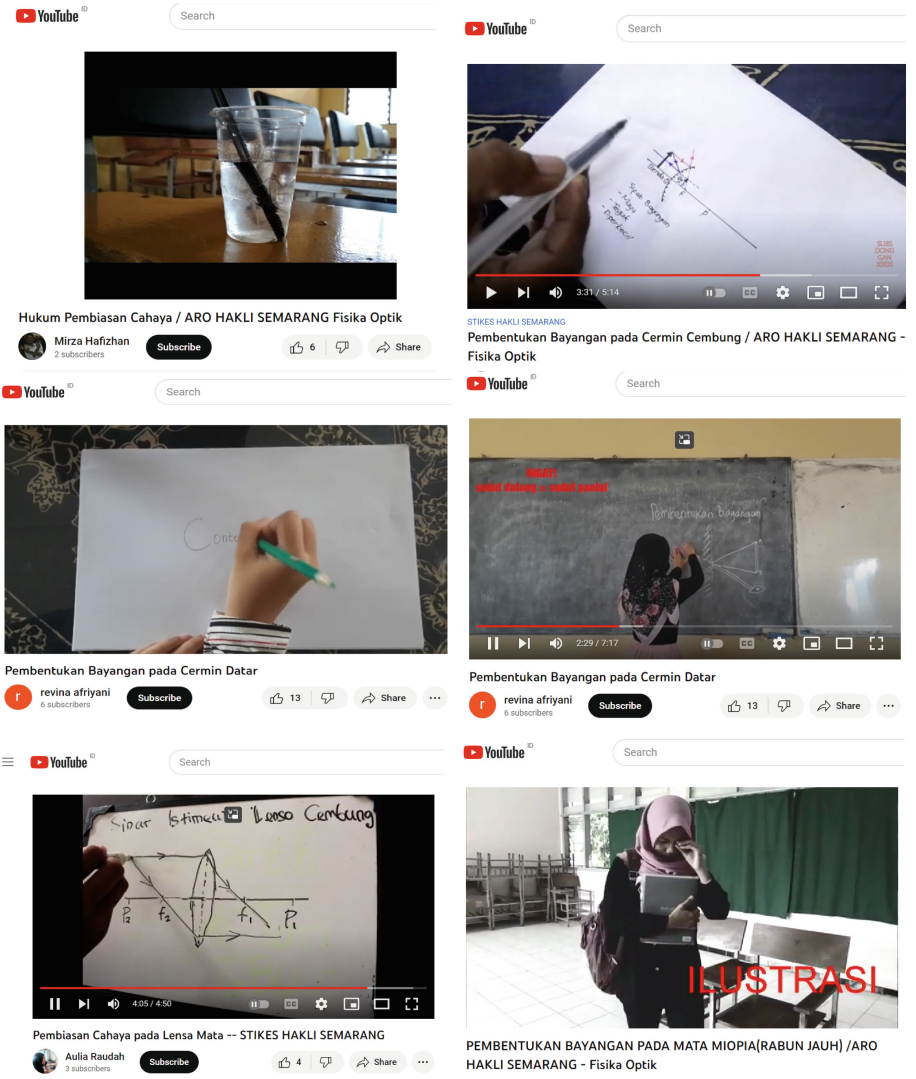

Fig. 1. Students' Product of project-based learning

When evaluating each facet of Learning materials, it is discovered that project-based learning activities receive the highest mark of 95%. Therefore, it can be stated that instructional materials in project-based learning can enhance the active learning process and make learning activities enjoyable. In the second order, the learning subject matter is highly engaging since students can participate directly.

The findings that can be seen in Fig. 2 shows that the implementation of project-based learning can encourage students to understand materials well with active learning activities. This is relevant with the previous finding that Students are challenged to

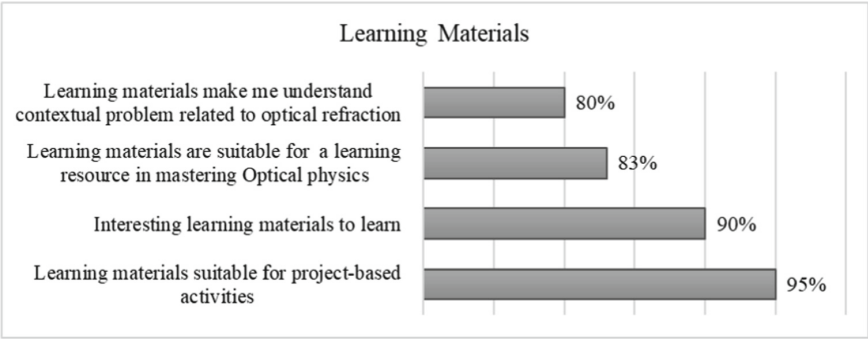

Fig. 2. Students' perception on learning materials in project-based learning

answer contextual and real life problems by creating a project related to ongoing learning materials when utilizing the PjBL model of instruction [2].

Furthermore, the findings demonstrated in Fig. 3 indicate that the implementation of project-based learning is perceived in seven aspects. The aspect with the highest score from students' perceptions pertains to students' perceptions pertain to learning activities allowing to improve implementation of project-based learning allow students to develop their communication and responsibility skills by collaborating with their peers., with respective scores of 95% and 9%. Under the score. 87 percent of students' grades are based on their ability to acquire a material understanding of optical physics through learning activities. The lowest value of this data from the findings pertains to the contextual nature of learning activities, which is 86% associated with investing and challenging activities. This challenge in the realm of optical repair receives an 80%. However, this score is still within the acceptable range.

As shown in Fig. 3, this finding corroborates the previous study [7]. Project-based learning simultaneously and partially affects concept comprehension, critical thinking skills, and physics learning outcomes [7]. This learning allows students to collaborate with classmates and exchange ideas. This learning also allows students to engage in active and autonomous learning to assume greater responsibility for the learning process and its outcomes.

The last findings related to the leaning resources (see Fig. 4) demonstrate that all characteristics connected to the category of learning materials that can be utilized in the Project-based learning process have a very high perception score among students. The element with the highest score, 95%, is with self-explored learning materials from online learning resources, students perceive that they can easily comprehend the topic studied through project-based learning activities. This data supported with the previous study that The implementation of PjBL can create a collaborative role within a team, as well as creative and successful collaboration between teachers and students, or students and students by recognizing, defining, and comprehending multiple information sources and topics matter components [8].

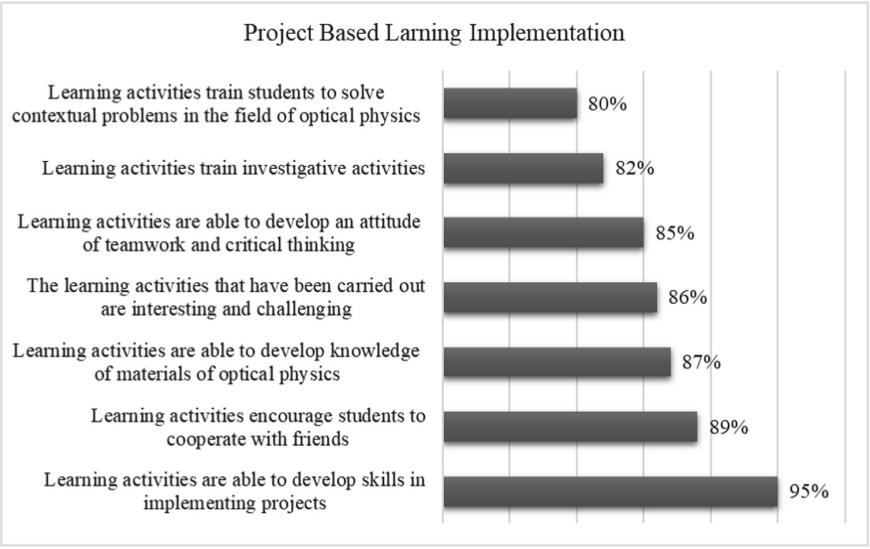

Fig. 3. Students' perceptions on the implementation of project-based learning

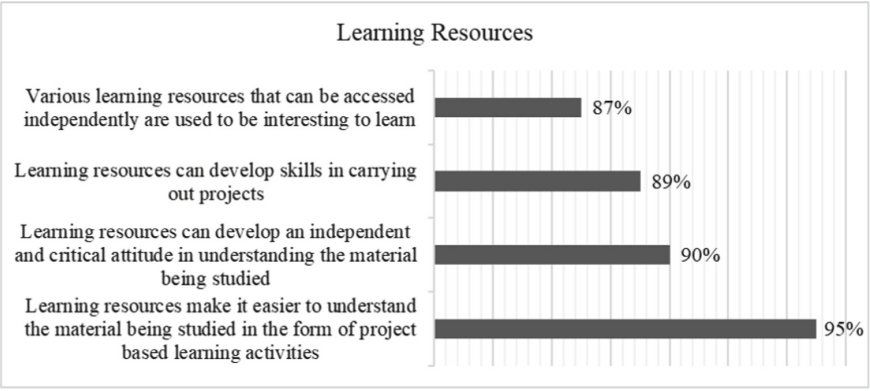

Fig. 4. Students' Perceptions on the learning resources in project-based learning

4 Conclusion

This study explored students' perceptions about implementing project-based learning in mastering optical physics. The findings show that in project-based learning, instructional materials can increase the active learning process and make learning activities more engaging. By cooperating with their peers, students can strengthen their communication and responsibility skills due to their views of learning activities that will improve the implementation of project-based learning. With self-explored learning materials from online learning resources, students believe they can easily comprehend the subject matter studied through project-based learning activities. Therefore, referring to the findings,

this study implies that project-based learning materials can be considered the potential teaching learning instruction for the optical physics course.

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