How Preservice Teachers Perceive Their Collaboration Team Working Skills During PjBL

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Abstract: The PjBL approach is applied to the Physics Laboratory Management course to support the achievement of learning outcomes. Through PjBL, preservice teachers are given assignments related to their future work as teachers and are required to complete them in groups. This study aims to determine how preservice teachers perceive their collaborative skills while interacting with group members when completing assignments. This research applied a mixed-methods approach to better understand research problems by quantitative and qualitative data. We employ total population sampling to examine the entire population with a particular set of characteristics from 67 people who completed the group project assignment. We analyze and describe the quantitative and qualitative data results to answer preservice teachers' perceptions of their collaborative team working skills during PjBL. We prefer the explanatory design method, where qualitative data is needed to explain the significant quantitative results. As a result, Preservice Teachers' perception shows that during PjBL, they have obtained collaboration skills in teamwork, managing conflicts, decision making, and communication skills. From the interviews, we dig up additional information about their complaints about the difficulty of completing projects and working in teams. However, the benefits of the additional skills they get are more profitable than their challenges. This analysis informs us that Preservice Teachers show a more significant positive response regarding collaboration skills during PjBL. It can be considered to continue to bring up collaboration skills in any given learning approach.

Keywords: Collaboration skills; Perceive; PjBL; Preservice teacher

Introduction

The world has just undergone tremendous changes throughout the years 2020 and 2021 recently (Sharfuddin, 2020). Although changes in the world always happen, they will be recorded as a big difference this time. Other more challenging and complex problems may arise in the future. Several institutions/organizations engaged in charity under the United Nations have listed the most pressing problems facing the world global issues (Brown, 2022; United Nations, 2022). Consequently, we need to know the inequality of rapidly changing world (United Nations, 2020) and study it to start innovating to find solutions. The results show that no one respondents disagree with the fact.

Such conditions attract responsibility not only from the government but also researchers to take the role in contributing to finding solutions according to their expertise (Nilsson & Bergendahl, 2020). However, we also understand that the world's problems are very complex. It is not easy for an individual with just one mastery to develop a solution that actually solves the world's problems. It is conceivable that the problems we face can be solved. The key is to look at the problem from multiple perspectives, try to apply multiple solutions, and collaborate with multiple experts (Khoiri et al., 2019) to create the right innovation. It means that solving world problems requires several expert thoughts and the need for collaborative activities from various parties.

Creating a situation where several people with many skills come together, collaborate, and work in a

team to produce innovation requires being conditioned. Higher education plays a role in developing a curriculum that provides students with solution-creating skills. Through applied learning, education prepares the next generation of solutions for the world's needs through applied learning (Vogler et al., 2021). Here, as the producer of preservice teachers, we try to preserve how students build their skills, knowledge, and soft skills through experienced learning (Qing et al., 2010). Several subsequent studies were also carried out by Erdawati et al. (2021), who investigated a learning method to improve teachers' science process skills, and Fitriani et al. (2022), who applies a learning model to train students' critical thinking skills. We all believe that learning at the higher education level should facilitate students to prepare their skills in the world of work through all of this.

The reality is that in the world of work, graduates student will not be faced with developmental or social challenges that can be solved individually (Wurdinger & Qureshi, 2015). However, they need to work together, share roles, make decisions through discussion, communication, and opinion, and collaborate in teams. This condition must be experienced by students in the form of class simulation in a lesson. Institution of higher education today has been trying to provide students with both hard skills referring to cognitive and professional skills, and soft skills such as problem-solving, critical thinking, collaboration, and team working (Valtonen et al., 2021). However, the skills with these achievements are not easy to achieve if they are still using conventional learning which only acts to transfer knowledge. Barring if they are given learning with a design project that has an impact on attitudes, motivation, and learning (Trust et al., 2022) or learning with a project-based model that can improve students' problem-solving skills (Purwaningsih et al., 2020).

The Government of Indonesia, through Permendikbud Number 3 of 2020 concerning national standards of higher education, recommends that the learning process at the undergraduate/diploma level can demonstrate aspects of innovative excellence that are held using the case method or team-based project learning (Puspitasari et al., 2021). This learning method is to create a collaborative and participatory class (Susanti et al., 2021). Students in groups will be given a real problem or complex question, then given space to make work plans and collaboration models to prepare the presentation of their final work. Such a learning process will hone the 4C skills (communication, collaboration, critical thinking, and creativity) (Musa et al., 2012), essential in the 21st century.

Multiple research studies, such as form Kuppuswamy et al. (2020) and Rajan et al., (2019)

suggest that students are engaged in their learning when creating and completing projects and they learn life skills such as communication skills, problem-solving skills, collaborating skill, team work skill, and willingness to learn. It is a promising learning model to answer the needs and demands of the 21st century. To develop long term knowledge, students need to be directed to learn by building their knowledge. Through the PjBL learning model, in which students work to produce valuable products according to the context of their needs, learning outcomes will be more meaningful.

There is no single definition of PjBL, but it can be defined briefly as a model for a classroom activity that shifts away from the usual teacher-centered learning to student-centered learning. PjBL is an authentic learning model or strategy in which student plans, implements, and evaluates projects that have real-world applications beyond the classroom (Guo et al., 2020). PjBL is based on constructivism theory, supporting students to do problem-solving. That is, as explained earlier, about the needs or skills needed/demanded by the world of work in the present and future. PjBL refers to an inquiry-based instructional method that engages learners in knowledge construction by having them accomplish meaningful projects and develop real-world products (Guo et al., 2020). PjBL is based on constructivism theory, supporting students to do problem-solving. That is, as explained earlier, about the needs or skills needed/demanded by the world of work in the present and future. PjBL refers to an inquiry-based instructional method that engages learners in knowledge construction by having them accomplish meaningful projects and develop real-world products (Vogler et al., 2018). This creation process requires learners to work together to find solutions to authentic problems in knowledge integration, application, and construction. Several studies mentioned that students also felt that PjBL encouraged their collaboration and negotiation within the group (Guo et al., 2020).

In conformity with the continual development of knowledge related to learning theories, this project-based learning model has been applied in several lectures, especially in the Department of Physics Education, University of Siliwangi. With this opportunity, we gather information on how the response from students who attended courses related to its implementation. It is essential to know how they perceive collaboration work in a team and learn how they thought about the experience during the performance of the PjBL model in the course.

This study will consider how sufficiently the PjBL model is chosen in forthcoming education. By knowing how physics preservice teachers perceive PjBL learning outcomes, researchers can predict learning models that

can be applied in higher education. The research results will also open up knowledge towards learning that can construct more skills needed by students in the world of work.

Method

The research was conducted on preservice teachers who contracted Physics Laboratory Management courses and completed class project assignments in groups. Questionnaires and interviews were shared after taking lectures that applied the PjBL model for 14 meetings. Explanations on implementing the PjBL model, project assignments, and group division have been delivered since the lecture contract at the first meeting.

We use a purposive sampling technique with total population sampling to examine the entire population with a particular set of characteristics (Lund Research, 2012). We define the population as course participants who have completed the group project. Then we create a list of the population of 67 people and contact all of them on the list in class. Since total population sampling involves all members within the population of interest, it is possible to get depth insight into the phenomenon we are interested in. With such broad population coverage, there is also a reduced risk of missing potential insight from not included members (Lavrakas, 2008).

Figure 1. Explanatory design procedure (Creswell et al., 2007)

All data were collected through a form that was distributed to respondents through the Google Classroom application and transferred to MS Excel or MS Word as needed. This research applied a mixed-methods approach to better understand research problems by quantitative and qualitative data. This method can effectively lead us to build research stages from quantitative studies to be followed up with qualitative ones to obtain more detailed specific information from the test results (Ghasempour et al., 2014), as shown in Figure 1. Creswell and Clark (2007) have mentioned that the most crucial step in mixed-methods research is the procedure for collecting, analyzing, and combining quantitative and qualitative research and methods in one study to understand the research problem.

A different instrument is prepared for quantitative and qualitative data needs. As quantitative data, questions were prepared consisting of four indicators related to teamwork skills (Musa et al., 2012). The questionnaire uses ten statements with answers using a 1 – 4 point Likert scale with 1 being disagree and 4 strongly agreeing. This section surveys respondents' perceptions of teamwork during PjBL. The questionnaire findings were analyzed using MS Excel, and statistical data were obtained. The result is the response of preservice teachers in the form of frequency and percentage, and the results are described.

Meanwhile, as qualitative data information, interview instruments were provided with structured questions (Robleda, 2019). Respondents' answers were open, but the researcher did not give any response to the given answers. Both questions and answers are shared and submitted in written form. It means that the answers of all respondents are fair and steady. There is no additional question or information on all samples. Processing of interview data is carried out through the stages of data categorization, data presentation, and data verification (Vogler et al., 2018).

The researcher systematically read each participant's comment (Hartwell et al., 2019) to determine whether it answered one of the two interview questions. Researchers categorize respondents' answers where each researcher does it without communicating with each other first. The categories of respondents' answers are based on four indicators of collaborative teamwork skills as given in the questionnaire instrument. We read and re-read the answers to highlight and examine the relationship between the questions – keywords – indicators using the MS Word review feature. The results of the work of each research member are then discussed so that the data categorization is obtained from the results of repeated checks. The number of statements that have been entered into this collaborative teamwork skill indicator will finally be presented and described to support the previous data.
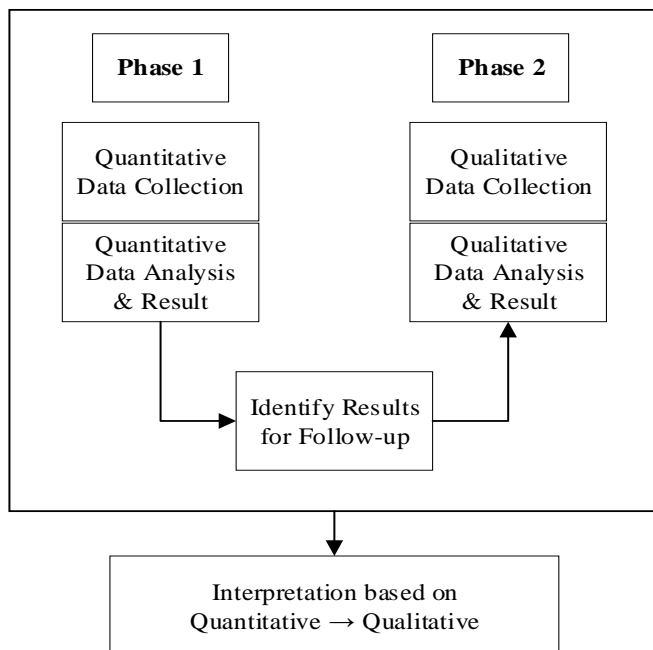
We analyze and describe the results of quantitative and qualitative data to answer preservice teachers' perceptions of their collaborative team working skills during PjBL. We used the explanatory design method (Creswell et al., 2007) Figure 1, where the researcher needed qualitative data to explain the significant quantitative results.

Result and Discussion

Data on preservice teachers' perception' of their collaboration team-working skills during PjBL in the first phase of the study were collected through questionnaires. Respondents were presented with ten statements that describe the four indicators of collaboration working skills in teams. The teamwork and managing conflict indicators present three statements, while the decision-making and communication skill indicators each present two. Respondents assess their achievement of collaboration skills in teams based on their performed experience while accomplishing the project assignments in the course. The respondents' answers are processed into quantitative data. The percentage of each statement in each indicator is presented in Table 1.

Table 1. Respondent's Statistical Data on the Experience of Collaboration Team Working During PjBL

Indicator	Statement	Disagree (%)	Unsure (%)	Agree (%)	Strongly Agree (%)
Team work	1. I build my work skills in groups when solving problems and completing assignments	0	4	49	47
	2. I learned that good teamwork can contribute to the success of project assignments	0	1	15	83
	3. In the course of teamwork, I learned about delegating task responsibilities to members	0	1	63	36
Managing conflicts	4. I learned to manage conflict in my groups	0	5	68	27
	5. I became more responsive and susceptive to the necessities of others during work in a group	0	15	55	29
	6. I learned to work successfully with a group of friends from different social and cultural backgrounds	0	1	51	47
Decision making	7. I learned to make decisions after the result of discussions with group member	0	1	32	67
	8. I learned to share roles and duties in groups	0	0	27	73
Communication skills	9. I learned to improve my public speaking skills during discussion activities	0	5	56	38
	10. I learn to use the formal and informal language of communication according to the context of the discourse when working in groups	0	1	60	38
Average (%)		0	3.4	46.7	49.9

Collaborative learning carried out by students during PjBL is not only to contribute collectively but also to be able to coordinate these efforts for themselves. (Vogler et al., 2018). Evaluation of how considerably PjBL impacts student learning outcomes is not examined further in this study. It is related to the difficulty of defining its consequence on student understanding. Most of the studies did not apply research designs that allow claims about their effect on learning outcomes. (Guo et al., 2020). However, this does not discourage the urge to evaluate PjBL activities through students' perceptions of the learning experiences they have experienced.

The results of the questionnaire data processing as shown in Table 2, no respondents disagreed with a statement related to the experience of collaborating in a team during PjBL learning. Most respondents agree and strongly agree about the experience of team collaboration during PjBL. Most of the answers, 15% of respondents, felt doubtful regarding the change in their attitude, which became more responsive and susceptive to the necessities of others during work in a group. While the most answers are 83% of respondents strongly agree that good teamwork can contribute to the success of project assignments. Thus, students indirectly acquire experience of a collaborative team working they learn and feel during PjBL.

Knowing the result about the respondent's perception of the experience while collaborating with the team from the questionnaire data, the researcher also took interview data about the experience in the condition of perceived obstacles and benefits. At the interview stage, the researcher asked two questions that are:

How about your experience with the obstacles encountered during the course related to completing assignments in groups? And How about your experience with the usefulness you perceive now after completing assignments in groups?

Questions are given in writing so that all respondents can listen to these uniform questions carefully. Respondents also wrote down their answers, and the time given to respond was quite long. So that they have enough time to seriously give answers according to their perception of the learning they feel. These results are significant to support the information that has been obtained from processing quantitative data on the questionnaire.

Respondents' exempt answer data about the disadvantages and advantages of completing assignments in a group were collected. In the next stage, the researcher categorizes the respondents' answers into indicators. After that stage, the data also goes through the data presentation and data verification process to obtain a complete presentation of the group of answers based on the description per indicator. The results of our answer categorization are presented in Table 2.

Table 2. Indicator Related to Description and Respondent Answer Example

Indicator	Description	Example answer
Team work	The process of working collaboratively with group members. They can tell about the achievement of project goals or the impression of colleagues' working skills.	For advantage: "I feel satisfied for work with a dependable/trustworthy team so..." For disadvantages: "We have problems at the beginning because of team members who less contribute by reason of..."
Managing conflict	The process of dealing with variances or conflict arising from differences of opinion. They can tell about difficulties in accepting differences in groups, being perceptive to the needs of others, or being sensitive to the problems facing the group.	For advantages: "In our group, each member has different skills, so we divide roles, entrust the work to members, and are able to complete the project" For disadvantages: "I have to accept mates who have never worked with me before and arrange a schedule together", "The biggest difficulty is staying persistent and consistent in completing project tasks to the end"
Decision making	The process of deciding course of action. They can tell about choose an action after discussion or share roles and duties of members in group	For advantages: "we learn to be responsible with our roles and tasks in the group, then we focus on completing our project" For disadvantage: "Difficulties that we face at the beginning of the discussion are when choosing the theme of our project because there were many different ideas in our mind"
Communication skills	The abilities to give and receive information. They can tell about how to listen others, make conversation, and have interaction during class or project presentation	For advantages: "we learn to present our work in front of an audience, our ability to express it verbally is very important" For disadvantages: "I need to learn more about how to express my ideas to others in easy-to-reach language"

Working collaboratively in a team needs effort. It requires individuals not only to contribute to the collective but also to coordinate those efforts among themselves (Vogler et al., 2018). Many respondents mentioned the obstacles in managing conflict, team-working, communication skills, then decision-making sequentially. However, respondents also replied about the advantages of assembling cooperation, sharing roles according to expertise, making decisions by discussion, discussing in expressing opinions or suggestions, and the rest about the satisfaction of achieving the goals of their group projects.

From the results of the respondents' interview responses, we grouped the preferences of the answers and calculated them in percentage presentations. The grouping of answers was done by the four research members individually without interference from one another. Then we discuss the results together. We chose the grouping results for the same answers or the most votes, while the results of different answers between researchers were discussed again until we reached an

agreement. The grouping of respondents' responses before being presented has been carefully researched and limited by researchers to match the descriptions and groups of answers displayed in Table 2.

Based on the trend grouping of respondents' answers to interview questions on the indicators of experience of collaborating teamwork, we display the data in Table 3. This table presents data according to the number of words repeated in the response that appear or are expressed by respondents related to the indicators. The disadvantages are calculated from the respondent's answer to the first question in the interview, while the advantages of the respondent's answer to the second question. The total percentage of each expressing disadvantages and advantages is 100% of respondents' answers processed as our qualitative data.

Table 3. Distribution of Respondents' Answers Regarding the Disadvantages and Advantages of Indicator Representation Results

Indicator	Disadvantages (%)	Advantages (%)
Team work	18	27
Managing conflict	67	24
Decision making	3	29
Communication skills	12	20

Regardless of the disadvantage that respondents complained about in the interview, they support this activity as an opportunity to improve their collaboration skills in a team. PjBL has been considered a way for students to sharpen their ability to work in teams, solve problems, make decisions, and communicate formally and informally.

In our study, we found the fact that the most difficulties experienced by students were in terms of managing conflict. From the questionnaire data, statements related to the managing conflict indicator obtained the highest percentage, compared to the other three indicators. We predict that respondents still have doubts about their achievements in managing conflict. In line with these results, the interview data also found respondents most frequently expressed problems. Most of them expressed difficulties in sharing work roles, entrusting work to group mates, completing difficult tasks, and being consistent with the group until project completion.

Students have felt the experience of collaborating team during PjBL. It can be seen in the respondents' answers in the questionnaire data which revealed that they agreed and strongly agreed with the PjBL learning achievements on the ability to collaborate in teams. No respondents disagreed with the statement of team collaboration skills indicators. Meanwhile, an average of 3.4% of respondents are still unsure about the achievement of their team collaboration abilities during PjBL. Through interview data, we also ensure that the benefits they feel during PjBL related to collaboration team working are evenly distributed across each indicator. For each indicator, all of them have answered above 20% regarding perceived advantages related to teamwork, managing conflict, decision making, and communication skills during PjBL.

Besides the results found in this study, the researcher is also aware of its shortcomings. The weakness in the implementation of PjBL this time is the level of students' collaborative learning have not various scientific backgrounds. In implementing PjBL in project-based lectures, students from multiple scientific backgrounds should be able to gather in one course. They can learn to work together and simulate the atmosphere in the work environment like real life. This idea also supports the implementation of the trend Merdeka Belajar at every higher school in Indonesia.

Conclusion

Perceive of preservice teachers regarding collaborative team-working skills during learning with the PjBL model was analyzed by collecting quantitative data through questionnaires and following up the results by collecting qualitative data through interviews. Respondents perceive their perceptions of the skill in collaboration work which were grouped into four indicators. The outcome shows them experience of additional skills after learning with PjBL in the form of the ability to team working, conflict managing, decisions making, and communication. The most severe difficulty they discern is in the indicator of managing conflict. However, the advantages of learning using PjBL are more deemed than the difficulties. The improvement in skills related to collaboration team-working is perceived evenly on all achievement indicators.

Author Contributions
Conceptualization, Rifa'atul Maulidah and Ernita Susanti; data curation, Ernita Susanti and Ifa Rifatul Mauhmudah; methodology, Rifa'atul Maulidah and Yanti Sofi Makiyah; visualization, Ifa Rifatul Mahmudah; project administration, Yanti Sofi Makiyah; writing—original draft preparation, Rifa'atul Maulidah; writing—review and editing, Ernita Susanti. All authors have read and agreed to the published version of the manuscript.

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