Pegem Journal of Education and Instruction, Vol. 13, No. 3 , 2023 (pp. 350-361)

RESEARCH ARTICLE WWW.PEGEGOG.NET

Phenomenological Studies: Strategies for Improving Indonesian Pre-Service Teacher Collaboration Skills

Panggih Priyambodo[1*], Paidi [2], Insih Wilujeng[3], Djukri[4]

1*Pogung Lor, 190, Mlati, Sleman Regency, Yogyakarta Special Region, Indonesia

[2-4]Yogyakarta State University, Indonesia.

Abstract

The efforts to empower collaboration skills are still a challenge for educational study programs in Indonesia. Various studies have focused more on efforts to improve collaboration skills, not exploring how lecturers' strategies are in training students' collaboration skills. This study aims to: 1) describe the lecturer's strategy for improving student collaboration skills, 2) describe the weaknesses of student collaboration skills, and 3) describe the lecturer's obstacles in improving student collaboration skills. There were 10 Biology Education lecturers involved in this phenomenology study. Data were collected through in-depth interviews and documentation and analyzed using *the thematic analysis technique*. The results showed that PjBL was the lecturers' most widely used learning strategy in improving student collaboration skills compared to other strategies. Specific strategies, such as implementing *Participatory Rural Appraisal* (PRA), were also adopted to promote student collaboration skills. PRA is used to optimize collaboration planning while coordinating student workloads. The results also show that students still experience various obstacles, especially in terms of communication, conflict resolution, and the formulation of collaboration results. The phenomenon of student participation inequalities is still a common problem for various universities. The factors causing the problems found included limited lecturer assistance, obstacles in preparing and developing assessment instruments, as well as obstacles in online learning during the COVID-19 pandemic. This finding is expected to be used as a reference for lecturers and researchers in developing student collaborative learning strategies.

Keywords: Collaboration, learning strategy, phenomenology study, pre-service teacher.

Introduction

Collaboration skills are one of the main competencies for pe-service teacher students. Collaboration skills play an important role in efforts to produce professional teachers (Durksen et al., 2017). Students trained to collaborate tend to desire to apply the same when they become teachers (Rigelman & Ruben, 2012; Tsybulsky & Muchnik-Rozanov, 2021). Collaboration skills allow teachers to discuss with each other to improve the quality of learning (Goddard et al., 2007). Collaboration between teachers has an impact on increasing critical thinking skills, metacognitive skills, collaboration skills, and student retention (Hamengkubuwono et al., 2022). Collaborative activities designed by teachers can also facilitate the development of collaboration skills in students as demanded by society in the 21st century (Liebech-Lien & Sjølie, 2021). Conversely, the low collaboration skills of students can encourage behaviour that only tends to pursue individual achievement by ignoring the importance of social interaction (Le et al., 2017).

Collaboration skills are one of the four main skills of the 21st century (Tican & Deniz, 2019). Collaboration refers to the involvement of several individuals to jointly overcome a problem in a coordinated manner (Lai, 2011). Collaboration is an interactive process where students work together to achieve a common goal (Lai, DiCerbo, & Foltz, 2017). The components that form collaboration include cooperation between two or more people, the nature of autonomous and voluntary cooperation, agreement regarding the mechanism of interaction, division of problem domains, joint decision-making, and the existence of a common goal (Newell & Bain, 2018).

Collaboration refers to group cooperation skills based on the principle of role bargaining. Collaboration is defined as group cooperation skills based on the principle of " *bargaining position* " or negotiation to achieve consensus and goals (Lai et al., 2017). Collaboration skills include interpersonal and management skills (Bosworth, 1994; Edmunds & Brown, 2010; Grover, 2005; Gunawardena, 2007; Knackendoffel et al., 2018; Lai et al., 2017; Stevens & Campion, 1994; Taggar & Brown, 2001). Interpersonal skills are a reference for building social relationships with others to achieve mutually beneficial social goals (Barakat, 2007; Hayes, 2002). Management skills are related

Corresponding Author e-mail: pangihpriyambodo.2019@student.uny.ac.id

https://orcid.org/0000-0002-0431-7027

How to cite this article: Priyambodo P, Paidi, Wilujeng I, Djukri. Phenomenological Studies: Strategies for Improving Indonesian Pre-Service Teacher Collaboration Skills. Pegem Journal of Education and Instruction, Vol. 13, No. 3, 2023, 350-361

Source of support: None.

Conflict of Interest: Nil..

DOI: 10.47750/pegegog.13.03.35

Received: 21.09.2022

Accepted: 02.12.2022 **Publication:** 01.07.2023

to managing organizational performance in a harmonious, effective and efficient manner by including skills in planning, implementing, and completing organizational tasks to achieve common goals (OECD, 2017; Taggar & Brown, 2001).

Collaboration skills are important to be integrated into the education process of pre-service teacher. Students as future " *new* teachers" have a crucial role in transforming the form of teaching from individual to collaborative learning (Santagata & Guarino, 2012). Educational institutions for pre-service teachers are responsible for producing professional teachers skilled in collaborating (Liebech-Lien & Sjølie, 2021; Mu'arifin et al., 2022; Rofik et al., 2022). Lecturers, as holders of strategic positions in universities, also need to implement various learning strategies to coordinate and monitor the effectiveness of student collaboration activities during learning (Wang, 2010). In the context of the "Merdeka Belajar" Curriculum in Indonesia, collaboration skills are important in developing student independence through project work.

There have been many studies focused on efforts to improve student collaboration skills. However, research that seeks to describe phenomena related to how lecturers' strategies improve student collaboration skills and, at the same time, achieve their impact has not been found. Therefore, the research questions are formulated as follows.

1. What are the various learning strategies applied by lecturers in improving student collaboration skills?
2. What are the aspects of student collaboration skills that are not yet optimal?
3. What are the obstacles for lecturers to train students' collaboration skills?

Method

Research Design

This research is a type of qualitative descriptive research with a phenomenological approach. The research is aimed at (1) describing the various strategies of lecturers in improving student collaboration skills, (2) describing aspects of student collaboration skills that are not yet optimal, and (3) describing lecturers' obstacles in improving student collaboration skills. Phenomenology is a valuable tool to reveal the life experiences of individuals in their world so that they can be used as a reference for many people (Neubauer et al., 2019). Therefore, the results of this study are expected to be used as a reference in determining the appropriate learning *treatment* in order to train the collaboration skills of prospective biology teacher students more optimally. This phenomenological study was conducted in March-August 2022.

Study Group

This study involved ten lecturers of biology education as respondents. Respondents were selected based on their experience in applying various learning strategies to improve the collaboration skills of pre-service teachers. The limited number of respondents is related to research time and funds availability. However, the ten respondents adequately represented various universities from the western part of Indonesia (WS, AFA, RPS, HRF, DM, and NKS), central Indonesia (RSH and AY), and eastern Indonesia (NL). Respondents HRF, NKS, and RSH themselves are affiliated with universities that accommodate students from the eastern part of Indonesia.

Data Collection

Data were collected using in-depth interview techniques. The substance of the interview includes an assessment of various general and specific learning strategies lecturers apply in training student collaboration skills and aspects of student collaboration skills that still require further handling. Aspects of collaboration skills used in this study include communication skills, conflict resolution, goal setting, planning, coordination and performance management, and synthesis of results (Bosworth, 1994; Edmunds & Brown, 2010; Grover, 2005; Gunawardena, 2007; Knackendoffel et al. ., 2018; Lai et al., 2017; Stevens & Campion, 1994; Taggar & Brown, 2001). In addition to in-depth interviews, researchers also use documentation techniques to collect lecturer learning tools and assessment instruments, as well as student artefacts

The interview activity begins with filling out a written questionnaire by the respondent. The results of filling out the questionnaire were then used as a reference in conducting in-depth oral interviews. Interview activities for each respondent were carried out through the Zoom application to overcome distance constraints. The interview process was also recorded for data analysis.

Data Analysis

Interview data were analyzed using thematic analysis. The thematic analysis stages include: familiarizing with the data, creating preliminary codes, looking for themes, reviewing themes, defining and naming themes, and creating the report (Braun & Clarke, 2006). Interview recording data were analyzed in depth and repeatedly for coding. The coding results are used as a reference for analyzing themes related to the formulation of research problems and then reported through a minimal organizational format but rich in descriptions (Braun & Clarke, 2006; Kabilan, 2013).

Findings

Strategy to Improve Student Collaboration Skills

Main Strategy

The main strategy lecturers apply to improve collaboration skills is *Project-Based Learning* (PjBL). This strategy is considered effective because it requires students to be able to

create or develop a variety of innovative products. The target of making products followed by exhibitions or publications will foster responsibility and concern for students to share ideas. The jigsaw integrated PjBL modification was also found in one of the respondents. This strategy is intended so that students are better prepared to collaborate in completing project assignments.

> "If the collaboration points are more to PjBL because children are challenged to make products. PjBL is a challenge. I give students a topic, *what can you do? something good to show off*. Everyone will think, and finally, they have ideas or ideas to exchange with each other. They can also collaborate to identify needs, design costs, and share the job desk (RSH).
>
> "Other lecturers as a team and I prefer to use PjBL based on the problems in the field. Students can map the problem, identify the factors that drive the problem, map out what alternative solutions are most likely to be taken, and choose which alternative solution is the best" (RCH).
>
> "Jigsaw's integrated PjBL and PJBL enable students to build knowledge through collaborative product creation, increase collaboration between students, and allow students to share roles in completing assignments" (WS).

The second strategy that is often used by lecturers is *problem-based learning* (PBL). The application of PBL is seen as facilitating students in studying real problems. Thus students will be motivated to carry out further learning activities, such as identifying problems, thinking and discussing problems, expressing opinions, working together to collect information, or formulating solutions.

> "The use of PBL makes students more active so that their communication skills can improve. Students dare to express opinions and criticize each other, whether it's right or wrong, we will straighten it out later" (NKS).
>
> "Using PBL is easier to direct students because at least we have prepared the case. The issues raised must be contextual. Students are more interested and more motivated" (AFA).
>
> "The PBL stage is related to structured and independent assignments to train collaboration and enable constructivist learning" (NL).
>
> Other strategies that are also applied include inquiry learning and service learning.
>
> "Inquiry allows students to find problems, formulate problems, find and determine research methods, formulate hypotheses, and others together" (AY).

The service learning strategy is also seen as being able to present challenges because it presents internal and external collaborative activities. Students have the opportunity to identify various needs or problems faced by targeted targets, such as teachers in schools. Thus, students can develop products as needed to provide concrete and valuable social services.

> "If I ask students, they give more meaning to service learning strategies. They can find out the teacher's problems, the obstacles, and the knowledge they can distribute" (RPS).

The application of collaborative learning strategies is supported by learning tools and assessment instruments. Some learning tools include lesson plans, modules, work instructions, and student worksheets. While the assessment techniques include performance observation, self-assessment, assessment between students, and product assessment.

Specific Strategy

Communication Skills

The most common strategy for practising student communication skills is through weekly project results reporting. Students are directed to compile weekly achievement reports in writing to be presented orally. Presentation activities are carried out alternately so that they can reach all students. This activity is also intended to train the development of a systematic flow of thought.

> "When students report the actual process they are telling a story, they will automatically get used to telling or reminding them about what they have done and what is the problem. And related to the ability of public speaking, it is about how what he (student) understands can also be understood by others" (RCH).

Lecturers also train communication skills by directing students to interact with various parties. This activity is considered to support the processes of identifying problems and needs, setting goals and planning collaboration, or communicating the products that have been developed.

> "Indeed, there are many products that we show to the public, and when there are ranks of the dean or rectorate coming, they (students) will present" (RSH).
>
> "Collaboration (students with the community) will be much more comfortable when students approach or fuse with the community first, so the goals of collaboration will be fulfilled (by itself)" (RCH).

While other forms of specific strategies are to provide feedback and corrections to some students' oral or written communication errors, socialize soft skills assessment targets at the beginning of the lecture, and provide instructions to try to minimize meaning bias while communicating with external parties. Meaning bias usually occurs in the communication

process using tools. In addition, the selection of contextual and fun topics was also proven to improve student communication. Students become more enthusiastic about learning, so they are moved to discuss and communicate with each other.

> "One of my findings (collaborative inquiry: mini research on marine biology) is that students who were initially quiet and inactive in class became active and brave in presenting data acquisition" (AY).

Conflict Resolution Skills

Specific strategies of lecturers in training conflict resolution skills tend to be limited to providing personal or group guidance. Lecturers generally assume that students' average level of development and age is sufficient to support conflict resolution independently.

> "I carried out the *coaching function,* and in the end, they were able to solve it themselves" (RSH).

> "Conflicts due to differences of opinion within one team, we provide keywords related to the correct answer even though it is not specific. Sometimes the students are noisy but what is discussed is out of line" (NKS).

Another finding encourages students to determine alternative solutions based on competency mapping and the last division of tasks. At the beginning of the activity, the lecturer trained students to carry out social mapping at the data assessment location and in the scope of their class through the Participatory Rural Appraisal (PRA) approach. The application of PRA in the classroom aims to map out specific forms of student's competency to divide tasks. If a conflict originates from an imbalance in workload, then alternative solutions can be traced based on the mapping results from the PRA.

> "Conflict usually occurs from reality that is not in line or balanced with expectations, so alternative solutions can be mapped based on observations and competency mapping from the beginning (through PRA). It can also be used for conflict management" (RCH).

Goal Setting Skills

The setting of collaboration goals tends to be dominated by the role of lecturers. The lecturers are accustomed to setting a topic or an umbrella problem theme and then dividing it into several specific themes for each group of students.

> "From the initial contract, we were the ones who set the goals of the collaboration, but if, for example, in the middle of the activity, there were problems, the students could participate in expressing their opinions. For example, in observing the metamorphosis of butterflies, it is difficult to find caterpillars or cocoons, so they can negotiate to replace them with other themes" (NKS).

> "For example, regarding (the topic of) Genetically Modified Organisms or GMOs, there is still *a debate in the community as to whether GMO products are safe or not" (DM).*

> *"Students* in the Biotechnology class study variants of the COVID-19 virus and vaccines during a pandemic (HRF).

Another finding shows that sometimes lecturers also create ways of setting collaboration goals. Lecturers try to stimulate student activity to get involved in the formulation of collaboration goals. In this case, the lecturer can instruct students to make direct observations using a needs analysis sheet, conduct interviews with potential product users, or examine existing product examples. Another way is to present the problem in the form of general instructions (such as pictures) that still require further student identification.

> "I took several representatives from students to communicate with the school to get initial information about their needs" (RPS).

> "I give some examples of products that have been produced by senior students. I asked them to observe first and then analyze the weaknesses, strengths, and depth of the material" (HRF).

> "I gave the problem, but I did not mention that it was DNA isolation, PCR, ..., they (students) identified themselves" (DM).

> "Students are assigned to conduct observations and needs analysis activities in schools" (WS).

> "I set and deliver assessment indicators in every assignment so that students translate the indicators themselves into their groups. I also handed over the task to the class leader to divide the material topics to each group until they were revealed to be learning objectives" (RSH).

Planning Skills

In general, students have been involved by lecturers in planning collaboration. The strategy for involving students in planning collaborative procedures varies between respondents. One respondent said that he instructed students to design research procedures on marine ecosystems based on studies of scientific journal articles. The respondent also directed the students to prepare the materials and equipment needed and determine the schedule and technical plans for the field. Other respondents shared the procedure for making fermented products randomly so students could sort them based on a literature review. Meanwhile, several other respondents shared product assessment rubrics as a reference in designing designs, directing students to find innovations, and giving students the flexibility to form collaborative groups. However, one respondent did outline the plans and targets of the collaboration activities completely and concretely.

"I ask all students to be involved in collaborative planning. So that they all understand what is being planned and know the target of the work. I will correct the potential of their collaborative planning, what is the work agenda, is it logical to do it within a certain deadline, if it is not logical then I will provide input" (RPS).

"Students look for articles as a foothold, and then the methods used by researchers in these articles will be adopted and re-applied at different loci" (AY).

"I did not give direct instructions in the LKM (Student Worksheet), but it was randomized first, and then the students had a discussion to determine how to take the right steps" (NL).

"Students are given an overview of the product assessment rubric as a reference material in designing the design" (WS).

"We want to see how students form groups, what criteria they choose from their group members, not only because they are close friends but other friends who rarely play so they can exchange ideas to get new insights " (AFA).

"At the beginning of the meeting, I give directions regarding project activities, and at the same time, I have planned monthly targets so that it will be known which students have not collected project achievements on Google Drive or Google Classroom " (RSH).

The intensity of social interaction and collaborative assignments are also considered to influence students' planning skills. Students can get to know each other's characteristics and abilities so that they can be a reference in the division of tasks. The special treatment from one of the respondents is to train the Participatory Rural Appraisal (PRA) approach. Students are trained to make social mapping among their peers in one class. The mapping contains a variety of specific skills of each student. The mapping results are then used to assign tasks. Another form of special treatment is to provide intervention in group formation. The composition of each group is made heterogeneous so that students can share tasks evenly according to their characteristics and expertise.

"Students can understand and learn on their own about the weaknesses and characteristics of their friends because the intensity of collaborative interactions is long enough from various courses so that they specialize in certain tasks in groups" (AFA).

"Every project that raises contextual issues must have a different mapping of PRA results. Let alone the mapping from the community involved, the mapping from the student team itself may vary. Maybe in the first team, some students have photoshop skills, the second team is financial management, and there may be other types of abilities in the third team. And such mapping is done before students go to the field" (RCH).

"I highlight each student's relationship background, interests, and abilities. Based on these different backgrounds and basic abilities, I place students with good learning performance combined with students at the intermediate level so they can learn from each other" (RPS).

Coordination and Performance Management Skill

Information on how the lecturer's strategy in training students' task coordination skills tends not to be obtained significantly. Socialization related to assessment aspects is still the mainstay of lecturers to stimulate activity and task alignment among students. Several assessment techniques commonly applied by lecturers include performance appraisal by observation, self-assessment, student-to-student assessment, and product assessment.

"I will provide information that the division of student tasks will determine the points or weights of the assessment based on the contribution made so that there will be an individual assessment" (RPS).

"The final evaluation in collaborative activities is usually using peer assessment. Each individual can express his thoughts privately regarding his friends' performance and himself during the project. The simplest questions are, who are the students who contribute the most and who contribute the least, and in what order the students concerned are in what order" (RCH).

"So far, I have done my performance appraisal. However, sometimes I worry that the assessment process is not following the student's condition, so I make a self-assessment and peer-assessment for confirmation" (RSH).

"Students know from the start that there will be a product assessment, so they are quite serious in presenting their best products together" (WS).

Meanwhile, individual and team performance optimization is generally pursued through monitoring activities. Technical implementation can be done by utilizing the Learning Management System (LMS), face-to-face learning schedules, or direct observation in the field.

"The process of making a product is not done once. For example, in creating a module, I pegged around four times. At the initial meeting, students presented the results of their observations at school, and at subsequent meetings, they presented the modules that were made to comment on what was lacking and then presented again at the next meeting until it was in line with expectations" (WS).

Logbook activities on the learning management system (LMS), and we also hold meetings to monitor their progress. We use

class schedules for students to make presentations. Due to the nature of the project, the periodicity is about one month" (RPS).

"Students coordinate all activities in field studies, but of course, we as lecturers participate in monitoring students" (AY).

"I have a progress report so that I can know the progress of each group. Later, we can evaluate or discuss it again in class" (NKS).

Several types of LMS have been provided and developed by the campus concerned, such as SPADA, Edlink, FLearn, and Be Smart. Other performance reporting techniques are carried out using Google Drive and Google Classroom. The periodic monitoring process is seen as a strategy that can stimulate and maintain student performance both individually and in teams.

"I prepared a student worksheet and then embedded it on Untirta's online learning platform, SPADA. Students send the articles they find to SPADA for me to comment on their suitability as a source of information" (DM).

"Students are divided into groups and then made spaces in the zoom. In each zoom room, students collaborate to work on assignments. As a lecturer, I will go around every zoom room to monitor students while helping if there are students who are having difficulties" (WS).

"Our LMS on campus has FLearn, the features used to access materials, assignments, attendance list, feedback, and evaluation (RPS).

In addition to performance appraisal and monitoring, one of the respondents obtained interesting information related to using Virtual Lab media. This platform is a source of information for students to support the creation of assignment outcomes.

" I use *the* Virtual Lab to help students understand how the DNA isolation procedure and PCR procedure are, what is the purpose, what ingredients, what are the steps, so I use the virtual lab as a source of information (DM).

Synthesis and Results Reporting Skills

The types of student outputs or products are quite varied, including books, audio and audiovisual learning media, application-based media, herbariums, scientific articles, various learning tools, assessment instruments, research proposals, or papers containing the results of generalizing problems. The strategy applied by the lecturers is to evaluate products and monitor performance regularly.

"I inspect student products two weeks before they are exhibited so that students still have time for improvement. And one week later I checked again, and it was determined whether it was good or not" (RSH).

"Students present the modules made to comment on what is lacking, and are presented again at the next meeting until it meets expectations" (WS).

"I used to tuck in lectures on how to deal with typos, cite references using Mendeley, or search for articles through Google Scholar and Publish or Perish. I also correct and check papers every time there is a presentation starting from the writing, grammar, and layout" (AY).

Weaknesses of Student Collaboration Skills

The application of collaborative learning strategies has not been fully able to train students' collaboration skills. The findings show that students still experience various obstacles in collaborating.

Communication Barriers

Oral communication skills among students are reported to have been quite effective. However, certain cases are deemed to require further training or development still.

"Teaching eastern Indonesian students is different from Javanese students. Javanese students may understand almost all Indonesian vocabulary, but for eastern Indonesian students, when sometimes I use a few words they rarely hear, they do not understand" (RSH).

"I said that students only dominate those who are active in oral communication - that's all in one class, the soft skills of the students here are still a bit difficult, they are not quite used to it" (NL).

Whatsapp communication sometimes I meet students who have not introduced themselves, such as from what study program, what semester" (AFA).

Conflict Resolution Constraints

Some of the students taught by the respondents were identified as not having good conflict resolution skills. Conflict usually occurs due to a lack of effective communication among students. Other findings also indicate that gender differences can sometimes trigger interpersonal conflicts.

"Conflicts are generally related to a lack of interaction due to gender differences or poor communication from the start. Moreover, when there is no initiation for professionals working on group activities, they are still carried away so that sometimes there are indifferent or individual things" (RPS).

"Big homework is for fellow students who cannot and are accustomed to observing or seeing a problem more deeply and thoroughly. If the A is invited to make an appointment, it will continue to be late. They have not been able to observe why his colleague is late" (RCH).

Inequality of Participation

Inequality of participation is still a conventional problem in a collaborative activity. The imbalance of contributions and workloads among students is still common and can trigger conflict. Inequality of participation can also occur both during the collaboration process and in reporting results.

> "Students tend to complete their part of the task without thinking about how the other friends' assignments will be. For example, some students document objects in the field, and when they are finished, they do not contribute to writing the targeted output" (AY).
>
> "There are group members who are less active in completing tasks, but because of their close friendship, they tend to understand each other. However, from the looks of them when they are in class, I can guess which ones are active and which ones are not" (AY).
>
> "Students with medium to lower average abilities tend to focus on their respective tasks. One or two students with medium and high abilities may want to help other friends (DM).
>
> "In my opinion, student contributions are still not equal, even students who are ready can be counted" (NL).
>
> "Sometimes students who are less active end up relying on their friends. How to get the dominant student to help his less active friend is still a bit difficult" (NKS).

Constraints and Reporting Results

Generally, students' language and writing skills that are not optimal have an impact on skills in synthesizing and communicating the collaboration results. This problem was almost identified in all respondents. Inequality of participation is another factor that affects students' skills in compiling the results of collaborative activities.

> "The weakness of my students is in the language, and then I have to be honest, some of them still have a sense of surrender to the product (book) and then copy and paste. I told them to re-work, and I would give them a zero if they still did not want to. It is obvious which one is plagiarism. The language skills of their products are still very low " (RSH).
>
> "Some students tend to be active in field activities, but when writing or compiling reports to be used as articles, they are still less active and have not used information technology" (AY).
>
> "I have seen a group that only reads when presenting but does not understand the concept. When asked, they were dumbfounded and just copied and pasted from the source. So they are not very good at managing information" (DM).
>
> "The way students write in Microsoft Word is not quite right. Sometimes they don't use spaces, and it seems they still need to teach writing about how to determine the contents of the first and second paragraphs" (AFA).
>
> "Writing skills are also heavy. I also happen to teach a thesis proposal seminar course. I think if it's a percentage, only about 40% of students can do it, while 60% are still lacking (NL).
>
> "Sometimes there are students who disappear, but later during presentations or product exhibitions there are" (HRF).

Lecturer Constraints

The most common obstacle experienced by the respondents was the limited time for intensive mentoring. The limited time then impacts providing feedback or a less comprehensive assessment.

> "I don't have time to supervise myself, but I always ask questions during (face-to-face) meetings" (RSH).
>
> "Performance assessment with my observations, because the number of students is not too many. However, indeed the limitation is the intensity of meetings. As for field activities, more thoroughness is needed" (RPS).
>
> "So, in the course of making teaching materials, there is a rubric to assess the teaching materials made by students. However, because there are many products, there are modules, LKPD, and videos, so they are overwhelmed. Finally, the assessment tends to be done in general, rather than one-on-one" (WS).
>
> "The main challenge of implementing learning strategies, both Problem-based Learning, Project-based Learning, and Service Learning, is in the time-related design. Its implementation ideally takes quite a long time" (RPS).

Another obstacle is the limitations of lecturers in developing an instrument for assessing student collaboration skills. Some respondents have not developed a product assessment, while others still have difficulties determining standards related to the aspects to be assessed.

> "Regarding the soft skills assessment, I have not found a reference or standard format. In the past, there was assistance on quality assurance, but when we asked about it, there was no. So we make our own according to our understanding" (NL).
>
> "The instrument is in the form of an observation sheet that I made with the team, but sometimes there is also an assessment between friends" (NKS).
>
> "I have never applied process assessment, but I went straight to peer-to-peer assessment and product assessment" (HRF).

The last obstacle or problem is online learning techniques during the pandemic. One of the most significant impacts is the limitation of students to examine problems in the field directly.

"I want students to go into the field, but (instead) I am free to look for journals because COVID-19 is constrained, so that lectures are still online" (AFA).

"So in the course of Making Teaching Materials, students must observe at school before making teaching materials. Meanwhile, the learning conditions are online. So the groups are divided based on location to make it easier for students to determine the location of the closest school and make it easier to make teaching material assignments together" (WS).

Discussion

Discussion of Finding Regarding Strategy to Improve Student Collaboration Skills

Main Strategy

PjBL is lecturers' most widely used strategy in training student collaboration skills. During the implementation of PjBL, students are involved in an authentic project to produce a product (Issa & Khataibeh, 2021). PjBL has been widely proven to facilitate the improvement of collaboration skills (Lee et al., 2015; N Church & Hussein, 2020; Zhao & Wang, 2022). PjBL trains students to manage conflict, make decisions and communicate effectively to become more independent, confident, and productive (Musa et al., 2011). PjBL facilitates the improvement of student collaboration skills through group collaboration activities and the discussion of ideas accompanied by scientific evidence (Zhao & Wang, 2022). Other learning strategies reported by respondents include PjBL integrated jigsaw, problem-based learning, inquiry learning, think pair share, and service learning. In essence, the key to success in efforts to improve student collaboration skills is in the hands of educators. Thus, educators must be competent in applying various collaborative learning strategies to optimize collaboration skills and students' academic achievements (Le et al., 2017).

Specific Strategy

Communication Skills

Weekly reporting is one way to train students' communication skills in a structured and systematic way. Weekly assignment reporting accompanied by lecturer feedback has increased students' confidence and public communication skills (Montgomery et al., 2022). Student communication skills can also be developed through learning design activities with mentors at school (Kabilan, 2013). Another specific strategy is through presenting contextual and challenging topics. Study topics like this can trigger student interest in interacting and exchanging ideas so that it has an impact on improving communication (Chung et al., 2016).

Conflict Resolution Skills Improvement Strategy

Conflict resolution skills are generally developed by lecturers through personal guidance. Group projects are a natural source of conflict because each group member tends to be personally successful. However, this desire is hindered by their positive dependence on the participation of their group mates (Donahoe, 2018). Therefore, lecturers must take on the role of motivator, facilitator, mentor, and scaffold provider in dealing with potential conflicts during collaboration (Habók & Nagy, 2016). One strategy that is considered quite effective is the implementation of PRA. PRA can encourage member participation and involvement through community mapping and social structures (Wati et al., 2021). Based on interviews, PRA is used to map specific competencies between students so that it can reduce the occurrence of workload imbalances as a trigger for conflict.

Goal Setting Skills

The study results indicate that students are still very dependent on the formulation of goals set by the lecturer. The determination of collaboration topics is still dominated by lecturers (Kovalyova et al., 2016). The involvement of students is generally only limited to the formulation of specific goals as a form of elaboration of the main objectives set by the lecturer. Student involvement in goal setting can develop learning-to-learn skills and independent learning management (Midwest Comprehensive Center, 2018). The implementation of PjBL can start by triggering a driving question that can become a framework for students to explore learning objectives and investigations (Krajcik & Shin, 2014). Another specific strategy is problem observation. Observation activities help students to set learning goals and solutions (Karlström & Hamza, 2021). Observation activities can help students formulate collaboration goals more targeted and representatively.

Planning Skills

One way to improve planning skills is to involve students in the planning process, accompanied by providing feedback. Planning skills can be developed through imitation, examples, and feedback (Kovalyova et al., 2016). Students are allowed to adopt activity plans from various works of literature. In addition, the implementation of PRA is also seen as effective in assisting the activity planning process. PRA can be used to identify problems as well as map the competencies needed to increase individual participation in the community (Wati et al., 2021). Individuals with better social skills can also be *role*

models for their peers (Lee et al., 2015). A good group is a group that can *survive* with the different views and experiences of its members (Donahoe, 2018).

Coordination Skills and Performance Management

Assessment activities tend to have a big influence on growing student motivation as well as student performance during collaboration. Various assessment techniques also need to be socialized from the start to be a reference for students in planning their performance. Performance appraisal triggers students to behave as expected by lecturers (Fastré et al., 2010). Peer-to-peer assessments have also been shown to encourage increased performance (Cifrian et al., 2020; Zulliger et al., 2022) and are even more effective than performance appraisals (Double et al., 2020). It is just that the lack of understanding regarding how to use it and social pressure among students can be different obstacles to its application (Li & Gao, 2015). The weakness of the performance appraisal technique and assessment among students can be overcome by adding comprehensive self-assessment and product assessment techniques. Performance appraisals accompanied by self-assessments can help students reflect on their learning processes and outcomes to improve performance (Max et al., 2022). Finally, product assessment also helps build student motivation to communicate with each other, share roles, and design products according to established criteria (Clark, 2017). In addition to assessment, monitoring accompanied by constructive feedback also helps student performance during collaboration. Monitoring activities in the form of weekly progress reports can be used to identify student difficulties during collaboration (Wang, 2010). Monitoring also allows educators to provide specific interventions and supports to harmonize students' knowledge acquisition activities individually and in groups (Kaendler et al., 2016).

Synthesis and Results Reporting Skills

The output target of collaborative activities is generally in the form of products or artefacts. Making concrete artefacts encourages students to maintain their cognitive work even though they experience difficulties (Miller & Krajcik, 2019). Based on the results of interviews, product assessment activities and weekly reporting impact students' results synthesis skills. Product assessment socialization can encourage product preparation (Clark, 2017). Discourse on publications and exhibitions of artefacts can also increase students' enthusiasm to present the best results (Yıldırım & Köklükaya, 2018). Various product errors during publication can be minimized through monitoring activities (Kovalyova et al., 2016). Determination of output targets is often able to bring satisfaction to students other than what can be obtained from the results of the lecturer's assessment.

Discussion of Finding Regarding The Weaknesses of Student Collaboration Skills

The application of various learning strategies has not fully impacted improving student collaboration skills as a whole. The findings indicate that the achievement of communication skills, conflict resolution, participation, and synthesis of student results is still not optimal and evenly distributed. This study's results align with previous research indicating that the development of collaboration skills of prospective biology teacher students in Indonesia is still being pursued (Indriwati et al., 2019; Malik & Ubaidillah, 2021; Sulistyaningrum et al., 2019). Inequality of participation (free-riding), problems related to resources, and interpersonal conflicts are often found in collaboration (Scager et al., 2016). Barriers to collaboration can come from limited collaboration skills among students, free-riding, competence, and friendship factors (Le et al., 2017). Furthermore, students in Asian countries also tend to prioritize personal feelings when collaborating affects critical attitudes (Le et al., 2017). Some of the weaknesses of student collaboration skills can be a material for reflection and attention for lecturers and researchers to develop the effectiveness of learning activities.

Discussion of Finding Regarding The Lecturer Constraints

The causes of the weakness of several aspects of student collaboration skills are the limited assistance of lecturers, the preparation of assessment instruments that are less comprehensive, and technical obstacles during the COVID-19 pandemic. Providing assistance or feedback both in determining collaboration strategies and at the same time implementing them, and planning the completion of tasks, including conflict resolution, can have a positive impact on student collaboration activities (van Leeuwen & Janssen, 2019). Emotional support from the teacher positively impacts student interaction and engagement (Havik & Westergård, 2020). However, the reality on the ground does show that educators tend to provide less instruction regarding how to collaborate effectively and, at the same time, do not balance the implementation of project activities with adequate assessment instruments (Eshuis et al., 2019). Careful and clear planning can help lecturers organize collaborative activities more effectively and efficiently.

Conclusion

Efforts to develop collaboration skills of pre-service teachers are still a challenge for the world of Indonesian education. First, based on the study results, it can be concluded that lecturer learning strategies for improving student collaboration skills include PjBL, PjBL-Jigsaw, PBL, Inquiry Learning, TPS, and Service Learning. While specific strategies for each aspect of collaboration skills include providing a learning

environment that supports communication processes, monitoring activities, providing guidance and feedback, assessment activities, training in the use of the PRA approach, and other strategies. Second, some students still experience problems in certain aspects of collaboration skills, especially in communicating, resolving conflicts effectively, and formulating and reporting collaboration results. The phenomenon of inequality of participation is still a common problem for almost all respondents. Third, the factors causing the problem include the limitations of lecturer assistance during the collaboration process, the limitations of lecturers in preparing and developing assessment instruments, and technical obstacles during the COVID-19 pandemic.

Suggestion

Strategies to improve student collaboration skills have been mapped into main and specific strategies. Some of these strategies can be a reference for lecturers in training and improving student collaboration skills. Specific strategies such as PRA can be adopted to optimize collaborative activities, from planning to reporting results. Meanwhile, related to several weaknesses, both from the students' and lecturers' points of view, it can be used as reflection material to fix patterns and scenarios of learning activities more effectively. More intensive facilitation of lecturers and the preparation of more comprehensive assessment techniques are seen as having a major impact on improving student performance during collaboration.

Limitation

The sample involved in this study consisted of 10 lecturers of biology education from various regions in Indonesia. As a result, the data obtained only describe learning strategies applied to one field of science. The main data collection technique is also limited to in-depth interviews accompanied by a recording. Thus, further research can reach specifications in a wider field of science with the addition of direct observation techniques.

Acknowledgement

The author expresses his gratitude and highest appreciation to the Directorate General of Higher Education, Research and Technology, Ministry of Education, Culture, Research, and Technology for providing funding support through the Doctoral Dissertation Research grant scheme (Contract Number: T/15.1.11/UN34.21/PT.01.03/2022)

Declarations of interest: none

References

Barakat, N. G. (2007). Interpersonal skills. *ABC Article*. https://doi.org/10.7135/upo9781843313274.007

Bosworth, K. (1994). Developing collaborative skills in college students. *New Directions for Teaching and Learning*, *59*, 25–31. https://doi.org/10.1002/tl.37219945905

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Chung, Y., Yoo, J., Kim, S. W., Lee, H., & Zeidler, D. L. (2016). Enhancing students' communication skills in the science classroom through socioscientific issues. *International Journal of Science and Mathematics Education*, *14*(1), 1–27. https://doi.org/10.1007/s10763-014-9557-6

Cifrian, E., Andrés, A., Galán, B., & Viguri, J. R. (2020). Integration of different assessment approaches : application to a project-based learning engineering course. *Education for Chemical Engineers*, *31*, 62–75. https://doi.org/10.1016/j.ece.2020.04.006

Clark, B. A. (2017). Project based learning: Assessing and measuring student participation. *Research and Evaluation in Literacy and Technology*, *39*.

Donahoe, A. E. (2018). Group projects as conflict management pedagogy. *Peace Review*, *30*(1), 45–52. https://doi.org/10.1080/10402659.2017.1419662

Double, K. S., McGrane, J. A., & Hopfenbeck, T. N. (2020). The impact of peer assessment on academic performance: A meta-analysis of control group studies. *Educational Psychology Review*, *32*(2), 481–509. https://doi.org/10.1007/s10648-019-09510-3

Durksen, T. L., Klassen, R. M., & Daniels, L. M. (2017). Motivation and collaboration: The keys to a developmental framework for teachers' professional learning. *Teaching and Teacher Education*, *67*, 53–66. https://doi.org/10.1016/j.tate.2017.05.011

Edmunds, S., & Brown, G. (2010). Effective small group learning: AMEE Guide No. 48. *Medical Teacher*, *32*(9), 715–726. https://doi.org/10.3109/0142159X.2010.505454

Eshuis, E. H., ter Vrugte, J., Anjewierden, A., Bollen, L., Sikken, J., & de Jong, T. (2019). Improving the quality of vocational students' collaboration and knowledge acquisition through instruction and joint reflection. *International Journal of Computer-Supported Collaborative Learning*, *14*(1), 53–76. https://doi.org/10.1007/s11412-019-09296-0

Fastré, G. M. J., van der Klink, M. R., & van Merriënboer, J. J. G. (2010). The effects of performance-based assessment criteria on student performance and self-assessment skills. *Advances in Health Sciences Education : Theory and Practice*, *15*(4), 517–532. https://doi.org/10.1007/s10459-009-9215-x

Goddard, Y. L., Goddard, R. D., & Tschannen-Moran, M. (2007). A theoretical and empirical investigation of teacher collaboration for school improvement and student achievement in public elementary schools. *Teachers College Record*, *109*(4), 877–896. https://doi.org/10.1177/016146810710900401

Grover, S. M. (2005). Shaping effective communication skills and therapeutic relationships at work: the foundation of collaboration. *Workplace Health and Safety*, *53*(4), 177–182. https://doi.org/10.1177/216507990505300408

Gunawardena. (2007). Management an overview. In *Management skills*. Commonwealth Secretariat. https://doi.org/10.4324/9781315260051-17

Habók, A., & Nagy, J. (2016). In-service teachers' perceptions of project-based learning. *SpringerPlus*, *5*(1), 1–14. https://doi.org/10.1186/s40064-016-1725-4

Hamengkubuwono, Asha, L., Warsah, I., Morganna, R., & Adhrianti, L. (2022). The effect of teacher collaboration as the embodiment of teacher leadership on educational management students' critical thinking skills. *European Journal of Educational Research*, *11*(3), 1315–1326. https://doi.org/10.12973/eu-jer.11.3.1315

Havik, T., & Westergård, E. (2020). Do teachers matter? Students' perceptions of classroom interactions and student engagement. *Scandinavian Journal of Educational Research*, *64*(4), 488–507. https://doi.org/10.1080/00313831.2019.1577754

Hayes, J. (2002). *Interpersonal skills at work* (2nd ed.). Routledge. https://doi.org/10.1049/et.2009.0803

Indriwati, S. E., Susilo, H., & Hermawan, I. M. S. (2019). Improving students' motivation and collaborative skills through Remap Jigsaw learning combined with modelling activities. *Jurnal Pendidikan Biologi Indonesia*, *5*(2), 177–184. https://doi.org/10.22219/jpbi.v5i2.7888

Issa, H. B., & Khataibeh, A. (2021). The effect of using project based learning on improving the critical thinking among upper basic students from teachers' perspectives. *Pegem Egitim ve Ogretim Dergisi*, *11*(2), 52–57. https://doi.org/10.14527/pegegog.2021.00

Kabilan, M. K. (2013). A phenomenological study of an international teaching practicum : Pre-service teachers ' experiences of professional development. *Teaching and Teacher Education*, *36*, 198–209. https://doi.org/10.1016/j.tate.2013.07.013

Karlström, M., & Hamza, K. (2021). How Do We Teach Planning to Pre-service Teachers–A Tentative Model. *Journal of Science Teacher Education*, *32*(6), 664–685. https://doi.org/10.1080/1046560X.2021.1875163

Knackendoffel, A., Dettmer, P., & Thurston, L. P. (2018). *Collaborating, consulting, and working in teams for students with special needs*. Pearson.

Kovalyova, Y. Y., Soboleva, A. V., & Kerimkulov, A. T. (2016). Project based learning in teaching communication skills in English as a foreign language to engineering students. *International Journal of Emerging Technologies in Learning*, *11*(4), 153–156. https://doi.org/10.3991/ijet.v11i04.5416

Krajcik, J. S., & Shin, N. (2014). Project-based learning. In *The Cambridge Handbook of the Learning Sciences* (pp. 275–297). Cambridge University Press. https://doi.org/10.1017/CBO9781139519526.018

Lai, E., DiCerbo, K., & Foltz, P. (2017). Skills for today: Collaboration. *Executive Development*, *3*(4), 6–12.

Lai, E. R. (2011). *Collaboration: A literature review research report* (Issue April). http://www.datec.org.uk/CHAT/chatmeta1.htm

Le, H., Janssen, J., & Wubbels, T. (2017). Collaborative learning practices: teacher and student perceived obstacles to effective student collaboration. *Cambridge Journal of Education*, *48*(1), 103–122. https://doi.org/10.1080/0305764X.2016.1259389

Lee, D., Huh, Y., & Reigeluth, C. M. (2015). Collaboration, intragroup conflict, and social skills in project-based learning. *Instructional Science*, *43*(5), 561–590. https://doi.org/10.1007/s11251-015-9348-7

Li, L., & Gao, F. (2015). Effect of peer assessment on project performance of students at different learning levels. *Visual Communication and Technology Education Faculty Publications*, *33*. https://scholarworks.bgsu.edu/vcte_pub/33

Liebech-Lien, B., & Sjølie, E. (2021). Teachers' conceptions and uses of student collaboration in the classroom. *Educational Research*, *63*(2), 212–228. https://doi.org/10.1080/00131881.2020.1839354

Malik, A., & Ubaidillah, M. (2021). Multiple skill laboratory activities: How to improve students' scientific communication and collaboration skills. *Jurnal Pendidikan IPA Indonesia*, *10*(4), 585–595. https://doi.org/10.15294/jpii.v10i4.31442

Max, A. L., Lukas, S., & Weitzel, H. (2022). The relationship between self-assessment and performance in learning TPACK: Are self-assessments a good way to support preservice teachers' learning? *Journal of Computer Assisted Learning*, *November 2021*, 1160–1172. https://doi.org/10.1111/jcal.12674

Midwest Comprehensive Center. (2018). *Student goal setting: An evidence-based practice*. https://files.eric.ed.gov/fulltext/ED589978.pdf

Miller, E. C., & Krajcik, J. S. (2019). Promoting deep learning through project-based learning: a design problem. *Disciplinary and Interdisciplinary Science Education Research*, *1*(1), 1–10. https://doi.org/10.1186/s43031-019-0009-6

Montgomery, T. D., Buchbinder, J. R., Gawalt, E. S., Iuliucci, R. J., Koch, A. S., Kotsikorou, E., Lackey, P. E., Lim, M. S., Rohde, J. J., Rupprecht, A. J., Srnec, M. N., Vernier, B., & Evanseck, J. D. (2022). The scientific method as a scaffold to enhance communication skills in chemistry. *Journal of Chemical Education*, *99*(6), 2338–2350. https://doi.org/10.1021/acs.jchemed.2c00113

Mu'arifin, Nurhasan, & Suroto. (2022). Model-based collaborative for professionalism development of sports and health physical education teachers in indonesia. *Pegem Egitim ve Ogretim Dergisi*, *12*(2), 10–17. https://doi.org/10.47750/pegegog.12.02.02

Musa, F., Mufti, N., Latiff, R. A., & Amin, M. M. (2011). Project-based learning: Promoting meaningful language learning for workplace skills. *Procedia - Social and Behavioral Sciences*, *18*, 187–195. https://doi.org/10.1016/j.sbspro.2011.05.027

Neubauer, B. E., Witkop, C. T., & Varpio, L. (2019). How phenomenology can help us learn from the experiences of others. *Perspectives on Medical Education*, *8*(2), 90–97. https://doi.org/10.1007/s40037-019-0509-2

Newell, C., & Bain, A. (2018). Defining collaboration and previewing success factors for effective collaboration. In *Team-Based Collaboration in Higher Education Learning and Teaching* (Issue 2013, pp. 9–27). https://doi.org/10.1007/978-981-13-1855-9_2

Ngereja, B., & Hussein, B. (2020). Does project-based learning (PBL) promote student learning? A performance evaluation. *Education Sciences*, *10*(330), 1–15. https://doi.org/10.3390/educsci10110330

OECD. (2017). PISA 2015 assessment and analytical framework: Science, reading, mathematic, financial literacy, and colloborative problem solving. In *PISA* (revised). OECD Publishing.

Rigelman, N. M., & Ruben, B. (2012). Creating foundations for collaboration in schools: Utilizing professional learning communities to support teacher candidate learning and visions of teaching. *Teaching and Teacher Education*, *28*(7), 979–989. https://doi.org/10.1016/j.tate.2012.05.004

Rofik, A., Setyosari, P., Effendi, M., & Sulto. (2022). The effect of collaborative problem solving & collaborative project-based

learning models to improve the project competences of pre-service teachers. *Pegem Egitim ve Ogretim Dergisi*, *12*(3), 130–143. https://doi.org/10.47750/pegegog.12.03.15

Santagata, R., & Guarino, J. (2012). Preparing future teachers to collaborate. *Issues in Teacher Education*, *21*(1), 59–69. https://files.eric.ed.gov/fulltext/EJ986816.pdf

Stevens, M. J., & Campion, M. A. (1994). The knowledge, skill, and ability requirements for teamwork: implications for human resource management. *Journal of Management*, *20*(2), 503–530. https://doi.org/10.1177/014920639402000210

Sulistyaningrum, H., Winata, A., & Cacik, S. (2019). Analisis kemampuan awal 21st century skills mahasiswa calon guru SD [Analyze of the initial 21st century skills of elementary school teacher students]. *Jurnal Pendidikan Dasar Nusantara*, *5*(1), 142–158. https://doi.org/10.29407/jpdn.v5i1.13068

Taggar, S., & Brown, T. C. (2001). Problem-solving team behaviors. *Small Group Research*, *32*(6), 698–726. https://doi.org/10.1177/104649640103200602

Tican, C., & Deniz, S. (2019). Pre-service teachers' opinions about the use of 21st century learner and 21st century teacher skills. *European Journal of Educational Research*, *8*(1), 181–197. https://doi.org/10.12973/eu-jer.8.1.181

Tsybulsky, D., & Muchnik-Rozanov, Y. (2021). Project-based learning in science-teacher pedagogical practicum: the role of emotional experiences in building preservice teachers' competencies. *Disciplinary and Interdisciplinary Science Education Research*, *3*(9), 1–12. https://doi.org/10.1186/s43031-021-00037-8

van Leeuwen, A., & Janssen, J. (2019). A systematic review of teacher guidance during collaborative learning in primary and secondary education. *Educational Research Review*, *27*(January), 71–89. https://doi.org/10.1016/j.edurev.2019.02.001

Wang, Q. (2010). Using online shared workspaces to support group collaborative learning. *Computers and Education*, *55*(3), 1270–1276. https://doi.org/10.1016/j.compedu.2010.05.023

Wati, R. F., Putri, E., Chasanah, N. R., Wicaksono, H., & Luthfi, A. (2021). Learning and Doing Participatory Rural Appraisal During the Covid-19 Pandemic in Empowering Communities. *Proceedings of the International Conference on Social Science, Political Science, and Humanities*, *495*, 284–288. https://doi.org/10.2991/assehr.k.210125.047

Yıldırım, E. G., & Köklükaya, A. N. (2018). The effect of project exhibition event on physics success and prospective teachers' opinions about projects. *Science Education International*, *29*(1), 39–48. https://doi.org/10.33828/sei.v29.i1.5

Zhao, Y., & Wang, L. (2022). Correction: A case study of student development across project-based learning units in middle school chemistry. *Disciplinary and Interdisciplinary Science Education Research*, *4*(1). https://doi.org/10.1186/s43031-022-00059-w

Zulliger, S., Buholzer, A., & Ruelmann, M. (2022). Observed quality of formative peer and self-assessment in everyday mathematics teaching and its effects on student performance. *European Journal of Educational Research*, *11*(2), 663–680. https://doi.org/10.12973/eu-jer.11.2.663