

Peer Feedback as an Innovation in Microteaching to Improve the Teaching Skills and Self-Efficacy of Prospective Physics Teachers

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Abstract

Microteaching is a training approach that enables prospective physics teachers to develop basic teaching skills and self-efficacy in a controlled environment, bridging pedagogical theory and classroom practice. This study examined the effectiveness of structured peer feedback in improving teaching skills and self-efficacy during microteaching. A pre-experimental one-group pretest-posttest design was employed with 10 Physics Education students. The instruments used consisted of a teaching skills questionnaire, a self-efficacy questionnaire, and a response questionnaire. All instruments were validated by experts, with Aiken's V coefficients greater than 0.80. Data were analyzed using descriptive statistics, N-gain, and the Wilcoxon Signed Ranks Test ($\alpha = 0.05$). The results indicated a significant improvement in teaching skills, with the mean score increasing from 1.67 to 3.62 out of a maximum score of 4, with a high N-gain of 0.84. Self-efficacy also increased from 1.78 to 3.69 on the same four-point scale, with a high N-gain of 0.86. Students reported positive perceptions of peer feedback, particularly in enhancing reflective practice, teaching techniques, and professional readiness. The results imply that integrating structured peer feedback into microteaching can strengthen reflective teaching practices and better prepare prospective physics teachers for classroom instruction. This study contributes empirical evidence on the combined effects of peer feedback in enhancing teaching skills and self-efficacy within physics teacher education.

Keywords: Microteaching, Peer Feedback, Physics Education, Self-efficacy, Teaching Skills.

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INTRODUCTION

Improving the quality of education depends heavily on the effectiveness of the learning process implemented by teachers. Teachers are not only required to master teaching materials but also to possess adequate pedagogical skills to face the challenges of 21st-century education. Technological developments, diverse student characteristics, and demands for learning innovation require teachers to continuously develop their professional competencies through ongoing training and reflection. However, traditional teacher education programs often emphasize mastery of theory over actual classroom practice. As a result, prospective teachers are not fully prepared to face complex learning situations. To bridge the gap between theory and practice, training strategies are needed that allow prospective teachers to practice teaching in a controlled and structured environment. One effective approach in this regard is microteaching. Microteaching is a compulsory course in teacher education

programs designed to hone teaching skills in simplified situations, both in terms of time, number of students, and learning materials (Iliasova et al., 2025). Through this approach, students can gradually practice mastering basic teaching skills such as opening and closing lessons, asking questions, providing reinforcement, explaining material, guiding discussions, and managing classes before entering actual teaching practice.

The accelerated transformation of the progressive world of education demands the development of adaptive competencies in prospective educators through a series of performance-based assignments relevant to the dynamics of 21st-century learning (Blegur et al., 2024). This is crucial considering that future challenges require teachers who not only master theory but also are able to integrate technology and innovation practically in the classroom, as well as master teaching skills. As prospective physics teachers, mastering teaching skills is one of the challenges that must be faced. Various recent studies offer diverse perspectives on the competency standards that a physics educator must meet to be able to meet challenges in the classroom. In general, these competencies do not stand alone, but rather are an integration of three main pillars: in-depth knowledge of physics content (including scientific skills), pedagogical competencies for managing reflective and effective learning, and social competencies rooted in a commitment to lifelong learning. All of these aspects are intertwined with the motivation, personal beliefs, and values held by teachers, which then shape the complexity of the curriculum in pre-service education. Given that the competency of new physics teachers is truly tested in real-world situations, practical training is an integral part of the academic journey of prospective teachers. Students are not only required to master the theory learned in lectures but also must directly engage in various clinical stages, ranging from classroom observations, teaching assistantships, to short teaching simulations or micro-teaching. Ultimately, prospective teachers must be able to practice full-fledged teaching in a secondary school setting under the guidance of experienced mentor teachers. This transition process from student to practitioner is crucial in shaping their readiness to face the dynamics of real-world physics education (Haverlíková & Horváth, 2024).

Microteaching is a strategic effort and a mandatory course for prospective teachers to practice basic teaching skills in simplified situations. Through this approach, students gradually master pedagogical aspects such as questioning techniques, explaining material, and classroom management before entering actual field practice. The implementation of microteaching as a learning tool and instructional practice laboratory is highly urgent in meeting the needs of students developing their teaching skills, forming a foundation of professionalism before entering the field (Ramang, 2023). However, reliance on the current conventional paradigm is considered to hinder student potential, necessitating a transformation towards digital-based learning designs to be relevant to the dynamics of the 21st century. Participation in microteaching has been shown to provide a fundamental contribution to acquiring practical experience essential for the professional development of prospective educators (Hamidi & Kinay, 2021). This experience serves as a pedagogical laboratory that facilitates students' transition into professional life in secondary schools through structured simulations. In addition to building self-confidence, mastery of these managerial and instructional skills positively impacts the efficiency of the teaching and learning process and student academic achievement. Furthermore, this approach is expected to create a technology-adaptive learning ecosystem while meeting students' expectations for interactive learning experiences (Mokhtar, 2015). As a practical training technique, microteaching provides ample opportunities for prospective teachers to design effective teaching strategies before facing real classrooms (Yundayani & Alghadari, 2024). Thus, the integration of traditional skills and digital innovation is key to shaping the teaching authority of future educators.

Developing the character of professional teachers is one of the primary goals of prospective teacher education. Teachers are crucial as primary mediators in the teaching and learning process. Therefore, teachers must possess the ability to create an effective learning environment (Amran et al., 2023). To become a teacher, one must know how to create lesson plans, prepare classes, and deliver material to students. To achieve this, prospective teachers need to be equipped with basic teaching skills from an early age. These skills are crucial because they form the foundation for implementing an effective and

engaging learning process. Teachers who possess basic teaching skills are able to effectively manage learning, create a conducive learning environment, and foster student motivation and interest in learning. Furthermore, teaching skills help teachers understand students' difficulties and organize and deliver material systematically and effectively. This concept was first developed at Stanford University in the 1960s by Dwight W. Allen as an effort to help prospective teachers practice specific teaching skills through a cycle of planning, implementation, observation, feedback, and re-teaching (Allen, 1967). In practice, microteaching provides prospective teachers with the opportunity to develop skills such as opening and closing lessons, asking questions, explaining material, managing the classroom, and guiding discussions in a simpler setting than a real classroom. In addition to improving technical skills, microteaching also encourages self-reflection, building confidence, and ongoing professional development. Through direct feedback from lecturers and colleagues, prospective teachers can identify strengths and weaknesses in their teaching practice, leading to continuous improvement. Thus, microteaching serves not only as teaching practice but also as a means of developing adaptive, reflective, and professional teachers. Furthermore, this microteaching approach not only strengthens teaching skills but also encourages the meaningful integration of technology into educational practice. (Lee & Wu, 2024).

In the dynamics of modern education, the use of verbal feedback between peers is now being widely implemented as an innovative alternative learning strategy. Peer feedback is particularly important because it provides immediate and constructive feedback that supports reflective learning and continuous improvement. It also encourages active participation, critical reflection, and collaborative learning, which are essential for developing prospective teachers' professional competence (García, 2024). Peer feedback provides a space for educators to exchange experiences, gain constructive feedback, and identify more effective teaching methods. Findings emphasize the positive impact of these practices in improving the quality of classroom learning and their potential to create an inclusive, collaborative, and innovative learning environment (Fatawi & Abidin, 2024). This approach positions students as active subjects directly involved in the evaluation process, rather than simply passive recipients of information in the classroom. By intensively involving students in the learning process, it is expected that there will be significant improvements in their academic skills, particularly in honing critical thinking skills. The dialogic interactions that occur during feedback enable students to analyze their peers' mistakes and successes from a more intimate perspective. This practice is particularly relevant in the context of micro-teaching classes, where prospective teachers practice their instructional skills on a small scale. Therefore, this study aims to explore in-depth student perceptions of the effectiveness of verbal feedback provided by classmates during these teaching simulations. Understanding these perceptions is crucial for determining the extent to which peer collaboration can shape the professional mentality and self-confidence of prospective educators before entering real schools (Larasaty & Reza, 2022).

Self-efficacy plays a crucial role in the dynamics of daily life because it drives individuals to optimize their potential in achieving future goals. Rather than merely reflecting an emotional state, self-efficacy represents an individual's cognitive belief in their capability to perform complex tasks and responsibilities. According to Social Cognitive Theory, self-efficacy is shaped by four primary sources of information: mastery experiences, vicarious experiences, social persuasion, and physiological and affective states (Clemente et al., 2024). Self-efficacy reflects the extent to which individuals believe in their capacity to succeed and influences how they plan, regulate, and evaluate their actions when facing challenges. Consequently, students with low self-efficacy tend to avoid challenging tasks, whereas those with high self-efficacy demonstrate greater persistence in overcoming difficulties. Furthermore, the level of persistence and effort invested in learning depends largely on students' confidence in their own abilities. Previous studies consistently report that higher self-efficacy is associated with better academic achievement, stronger learning motivation, improved teaching performance, and greater professional readiness among prospective teachers (Egele et al., 2025). In addition, educational interventions involving reflective practice, mentoring, and feedback have been shown to strengthen self-efficacy by providing opportunities for mastery experiences, social persuasion, and observational

learning (Marsono et al., 2024). However, empirical evidence on the effectiveness of structured peer feedback in simultaneously enhancing teaching skills and self-efficacy during microteaching remains limited, particularly among prospective physics teachers.

Although the potential of peer feedback has been widely recognized in educational literature, its integration into daily learning practices at the university level remains minimal. Many pre-service teacher education curricula remain trapped in conventional, one-way assessment models, where evaluation authority rests solely with the instructor or supervisor. This limited space for students to evaluate each other's performance results in a valuable opportunity to hone critical thinking and professional communication skills. The lack of utilization of this strategy is often due to instructors' concerns about the objectivity of assessments and students' lack of understanding of how to provide constructive criticism. Yet, without active involvement in the peer feedback process, pre-service teachers tend to struggle to develop the self-reflection skills that are essential for professional educators. Therefore, a repositioning of instructional design is needed so that peer feedback mechanisms can become an integral part, rather than merely an add-on, of teaching simulations. This article will examine these barriers and offer a framework for optimizing student collaboration to create a more participatory and dynamic learning ecosystem. This research examines the impact of microteaching with digital feedback on improving teaching skills, its role in strengthening self-reflection and lesson planning, and its impact on classroom management. A pre-test and post-test quasi-experimental design was used to compare the performance of the experimental group (which followed microteaching with digital feedback) and the control group (which followed the traditional microteaching method) in a teacher education program (Zhumabayeva et al., 2025).

Based on the theoretical and empirical background, this study investigates the role of peer feedback in enhancing the teaching skills and self-efficacy of prospective physics teachers during microteaching. Specifically, this study addresses the following research questions: (1) Does structured peer feedback significantly improve prospective physics teachers' basic teaching skills during microteaching? (2) Does structured peer feedback significantly enhance prospective physics teachers' self-efficacy? Answering these questions is expected to provide empirical evidence on the effectiveness of peer feedback as a pedagogical strategy for improving teaching competence and self-efficacy in physics teacher education.

METHODS

This study employed a quantitative approach using a pre-experimental one-group pretest–posttest design to examine the effectiveness of structured peer feedback in improving teaching skills and self-efficacy among prospective physics teachers. The study compared participants' teaching skills and self-efficacy before and after the implementation of peer feedback during microteaching activities.

The study was conducted during the even semester of the 2025/2026 academic year in the Microteaching course of the Physics Education Study Program. The participants consisted of all 10 sixth-semester students enrolled in one microteaching class. Therefore, a total sampling technique was applied because all students in the class participated as research subjects. Microteaching activities were conducted in a teaching laboratory designed to simulate authentic classroom situations in a controlled environment.

The intervention was implemented throughout the microteaching sessions using a structured peer feedback approach. Each student performed a teaching practice based on a predetermined lesson plan while the remaining students acted as observers. During the observation, peers evaluated the teaching performance using a structured feedback form based on eight basic teaching skills, including lesson opening, questioning, explaining, reinforcement, variation, classroom management, guiding discussions, and lesson closure. After each teaching session, every observer was required to provide written constructive feedback, highlighting both strengths and aspects requiring improvement according to the assessment criteria. The lecturer then facilitated a reflection session in which the feedback was discussed, enabling each student to identify areas for improvement before the next teaching practice.

Three research instruments were employed: (1) a teaching skills questionnaire, (2) a self-efficacy questionnaire, and (3) a response questionnaire. The instruments were validated by experts before

implementation, with Aiken's V coefficients exceeding 0.80, indicating good content validity. The questionnaires used a four-point Likert scale ranging from 1 to 4. The teaching skills questionnaire measured students' perceptions of their mastery of basic teaching skills, whereas the self-efficacy questionnaire measured their confidence in performing teaching tasks. The response questionnaire instrument was used to obtain information about the implementation of peer feedback in microteaching activities.

Data were collected using a pretest–posttest procedure. Before the peer feedback intervention, all participants completed the teaching skills and self-efficacy questionnaires as the pretest. Following the completion of the microteaching cycles and structured peer feedback sessions, the participants completed the same questionnaires as the posttest. All questionnaires were completed through self-assessment to measure changes in participants' perceived teaching skills and self-efficacy after the intervention.

The collected data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to summarize the mean scores of teaching skills and self-efficacy before and after the intervention. The normalized gain (N-gain) was calculated to determine the magnitude of improvement. Because the study involved only 10 participants, the data were analyzed using the non-parametric Wilcoxon Signed Ranks Test at a significance level of $\alpha = 0.05$ to examine whether the differences between the pretest and posttest scores were statistically significant.

RESULTS AND DISCUSSION

Results

The research results are presented with an analysis of changes in teaching skills and self-efficacy before and after the treatment. Pretest and posttest data were analyzed to determine differences in scores for each variable. Statistical testing was performed using a Wilcoxon Signed Ranks Test to determine the significance of the differences. The analysis results are presented in tables and graphs to support data interpretation.

Table 1 shows the pretest score analysis for teaching skills, with an average of 1.67 from 10 respondents. The minimum score obtained by respondents was 1.47, while the maximum score was 1.88. This score range indicates that respondents' teaching skills before treatment were in the low category. This condition indicates that teaching skills had not developed optimally in the early stages of the study. In general, respondents still experienced limitations in applying teaching skills. The variation in scores between respondents was relatively small, indicating relatively homogeneous initial abilities. These pretest results provide a picture of the initial condition of teaching skills before treatment.

Table 1. Descriptive statistics of pretest-posttest teaching skills scores

Statistics	N	Mean	Category
Pretest	10	1,67	Low
Posttest	10	3,62	High
N-Gain	10	0,64	High

The analysis of posttest scores for teaching skills among 10 respondents revealed an average score of 3.62, with a minimum score of 3.06 and a maximum score of 3.85. This range indicates that respondents' teaching skills after the treatment were within the high to very high performance categories. As shown in Figure 1, the average teaching skill score increased from 1.67 at the pretest stage to 3.62 at the posttest stage, resulting in an improvement of 1.95 points. This difference indicates a substantial improvement in teaching skills following the treatment. Furthermore, the posttest scores were close to the maximum of the assessment scale, suggesting that respondents were able to demonstrate teaching skills more effectively after participating in the treatment. Descriptively, all

respondents experienced an increase in scores compared with their initial performance. These findings are consistent with the descriptive statistical results and the pattern illustrated in Figure 1, indicating an overall improvement in respondents' teaching skills after the treatment.

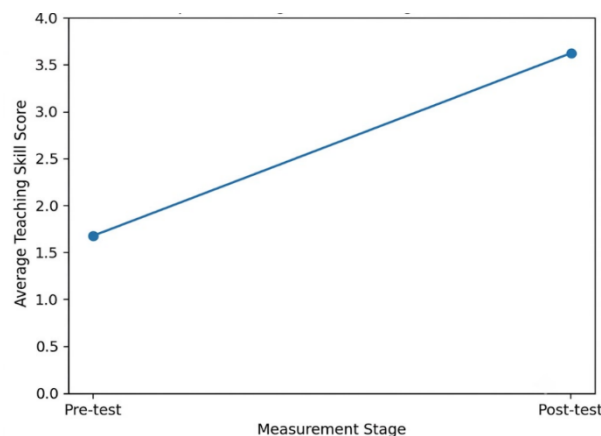


Figure 1. Comparison graph of average teaching skills scores pretest and posttest

The analysis results in Table 2 showed that the self-efficacy score before treatment was in the low category, with an average pretest score ranging from 1.38 to 2.04. After the treatment was given, the average posttest score increased significantly, namely in the range of 3.21 to 3.88. The change in score (gain) showed that all respondents experienced an increase in ability with a score difference between 1.58 to 2.13. The N-Gain value obtained was mostly in the high category, with an average N-Gain of 0.86. This finding indicates that the increase that occurred was not only significant numerically, but also proportionally meaningful. Comparison between conditions before and after treatment showed a consistent increase in ability in all respondents. Thus, the treatment given was proven effective in improving self-efficacy results.

Table 2. Comparison of self-efficacy scores before and after treatment

Statistics	N	Mean	Category
Pretest	10	1,78	Low
Posttest	10	3,69	High
N-Gain	10	0,86	High

Figure 2 shows an increase in the average self-efficacy score from the pretest to the posttest. The average self-efficacy score in the pretest was 1.78, while in the posttest it increased to 3.69. This increase in score indicates a significant change after the treatment was administered. Visually, the upward-sloping graph line illustrates a consistent increase in ability. This increase reflects an improvement in respondents' perceptions and self-assessments of their abilities. The results of this graph align with the gain and N-Gain calculations, which indicate a high increase. Therefore, this graph reinforces the finding that the treatment positively increased self-efficacy scores.

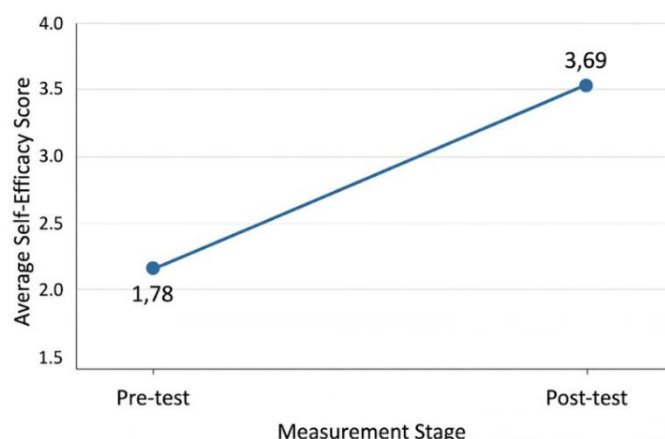


Figure 2. Graph of changes in self efficacy scores before and after treatment

Table 3 shows the results of the Wilcoxon Signed-Rank Test on the teaching skills variable, showing a significance value of 0.005 ($p < 0.05$). The average teaching skills score increased from 1.67 in the pretest stage to 3.62 in the posttest stage. This result indicates a significant difference between teaching skills before and after treatment. Thus, the null hypothesis is rejected, and the alternative hypothesis is accepted. This finding indicates that the treatment given has a significant effect on improving teaching skills. This increase reflects an improvement in the ability to carry out the learning process. The results of this Wilcoxon Signed-Rank Test confirm that the treatment is statistically effective in improving respondents' teaching skills. The results of the Wilcoxon Signed-Rank Test on the self-efficacy variable also show a significant difference between the pretest and posttest scores, with a significance value of 0.005 ($p < 0.05$). The average self-efficacy score increased from 1.78 to 3.69 after the treatment was given. This finding indicates that the treatment was able to increase respondents' self-confidence in their abilities. This increase in self-efficacy is in line with Bandura's theory, which states that self-efficacy plays an important role in determining an individual's behavior, effort, and persistence in carrying out a task. Individuals with high self-efficacy tend to be more confident, motivated, and able to overcome learning challenges. In the context of this study, increasing self-efficacy contributes to improving respondents' teaching skills. Thus, the results of the Wilcoxon Signed Ranks Test strengthen that the treatment not only impacts the skill aspect, but also the psychological aspects that support teaching performance.

Table 3. Wilcoxon Signed-Rank test of teaching skills and self-efficacy

	Post - Pre	
	Teaching Skills	Self-Efficacy
Z	-2,812	-2,810
Asymp. Sig. (2-tailed)	0,005	0,005

Based on the results of the student response questionnaire and open interviews regarding the implementation of peer feedback in microteaching activities, it was found that all respondents gave a positive response to the implementation of this strategy. In general, students viewed peer feedback as an effective means of self-reflection in identifying shortcomings and gradually improving teaching skills. Regarding the benefits of peer feedback in microteaching, the majority of students stated that this activity helped them recognize errors in material delivery, improve mental readiness, and train professionalism before entering the real class. One respondent stated that peer feedback "helps us to identify shortcomings or errors in material delivery, while also honing our professional mentality before entering the real class." This statement shows that students not only feel the technical impact, but also the psychological impact in developing teaching readiness.

Regarding changes in self-confidence during teaching, all respondents reported increased confidence after receiving peer feedback. Students became more confident in delivering material

because they now knew what needed improvement. As one respondent expressed, "I became more confident and calmer in front of the class because I now knew what areas needed improvement." However, some students admitted to still feeling a little nervous, but at a lower intensity than before. Regarding the challenge of receiving criticism from peers, most students stated that the peer feedback activity trained their mental readiness to accept criticism openly and non-defensively. Students learned to accept input with a professional attitude and convey criticism politely. One respondent stated that this activity "trained their mentality in accepting criticism without being emotional and learned to convey criticism politely." This indicates that peer feedback contributes to the development of reflective attitudes and emotional maturity in prospective teachers.

The impact of peer feedback on improving teaching skills is evident in students' increased awareness of aspects that need improvement, such as classroom management, questioning techniques, the use of varied methods, and the provision of reinforcement. Students stated that through peer evaluation, previously unnoticed errors became visible and could be immediately corrected in subsequent practice sessions. As one respondent stated, "I became aware of my shortcomings when teaching and could improve for the future." Overall, the results of the questionnaire and interviews showed that peer feedback was not only effective in improving technical teaching skills but also contributed significantly to increasing student self-efficacy. Students became more confident, reflective, and better prepared mentally to face real-life learning practices. These findings support the results of the quantitative analysis which showed a significant increase in teaching skill and self-efficacy scores after the implementation of peer feedback in microteaching.

Discussion

The results of the study indicate that the application of peer feedback in microteaching lectures has a significant impact on improving the teaching skills and self-efficacy of prospective physics teachers. This finding strengthens the assumption that microteaching not only serves as a means of practicing teaching techniques, but also as a means of building self-confidence and professional attitudes of prospective educators through reflective interactions among peers. The improvement in teaching skills is clearly visible from the comparison of pretest and posttest scores. In the initial stage, students' teaching skills were in the low category with an average score of 1.67. This condition reflects that students still experience limitations in applying basic teaching skills, such as opening and closing lessons, explaining material systematically, and managing classes effectively. However, after the implementation of structured peer feedback in each microteaching cycle, the average teaching skills score increased to 3.62, in the high to very high category. This improvement indicates that feedback from peers plays a significant role in helping students identify weaknesses in their teaching practices and make continuous improvements.

Pedagogically, peer feedback encourages students to actively participate in the learning evaluation process (Alzaid, 2017). Students not only act as practitioners but also as critical observers of their peers' performance. This process fosters analytical (Muslim, 2024), reflective (Sholikah et al., 2025), and professional communication skills (Isnani, 2026), which are essential in teaching. When students provide and receive feedback, an exchange of perspectives occurs, enriching their understanding of effective teaching practices. This aligns with the principles of microteaching, which emphasize the cycle of planning, implementation, observation, feedback, and improvement as the foundation for developing teaching skills. In addition to impacting teaching skills, peer feedback has also proven effective in improving student self-efficacy. The analysis showed that students' self-efficacy scores before the treatment were in the low category, with an average of 1.78. After receiving the treatment, the score increased to 3.69, a high category, and an N-Gain value of 0.86. This improvement indicates that students experienced strengthened self-confidence in their abilities to carry out teaching duties. Increased self-efficacy makes students more confident, calmer when teaching, and better prepared to face challenges in the learning process (Hengki & Ratna, 2025).

This increase in self-efficacy is inseparable from the constructive and dialogic nature of peer feedback. Feedback provided by peers tends to be delivered in language that is easier to understand

and in an equal setting, so students feel more comfortable accepting criticism. This supportive learning environment contributes to strengthening students' affective states, which ultimately positively impacts their perceptions of their abilities. Thus, peer feedback serves not only as an evaluation tool but also as a means of psychological support in microteaching. The results of student questionnaire responses and interviews further strengthen the quantitative findings of this study. Students generally responded positively to the implementation of peer feedback. They assessed that peer feedback helped identify previously unnoticed errors, increased mental preparedness, and fostered a professional attitude in receiving and delivering criticism. Students also reported increased confidence in teaching, although some still felt nervous at a lower intensity. This suggests that peer feedback plays a role in gradually building students' emotional readiness.

This finding is in line with the research of Haverlíková & Horváth (2024) which emphasized that structured practical training in science teacher education plays an important role in improving the professional readiness of prospective teachers. In addition, this result is also supported by the research of Marsono et al., (2024) which shows that peer interaction and direct teaching practice experience contribute significantly to increasing student self-efficacy. The implementation of innovation-based microteaching is also strengthened by the study of Iliasova et al., (2025) which concluded that the modern microteaching model is effective in improving the pedagogical competence of prospective teachers in a sustainable manner.

The challenge of accepting criticism is also an important part of this learning process. However, students view these challenges as meaningful learning experiences. Through peer feedback, students learn to be open, non-defensive, and able to reflect objectively. Thus, the application of peer feedback in microteaching not only improves students' technical and psychological competencies but also contributes to the development of the professional character of prospective teachers. This discussion demonstrates that peer feedback is a relevant and effective learning innovation in the context of microteaching. The integration of peer feedback can address two primary needs in prospective teacher education: mastery of basic teaching skills and strengthening the psychological aspect of self-efficacy. These two aspects are interrelated and inseparable, as good teaching skills will strengthen self-confidence, while high self-efficacy will encourage students to dare to try, experiment, and improve the quality of their teaching. This confidence arises because students gradually gain successful experiences, observe examples of teaching practices from colleagues, and receive verbal persuasion in the form of support and suggestions for improvement. Thus, the application of peer feedback in microteaching can be seen as a learning strategy that is oriented towards the holistic development of prospective teachers' professionalism, where students are not only trained to teach, but also formed into individuals who are reflective, confident, able to work together, and ready to face the dynamics of learning in real classes.

CONCLUSION

Based on the research objective to analyze the effectiveness of implementing peer feedback in microteaching on improving teaching skills and self-efficacy of prospective physics teachers, the results of this study clearly show that peer feedback has a significant effect on both variables. There was an increase in teaching skills from the low category to high, as well as an increase in self-efficacy with a high N-Gain category. Thus, the research objective was achieved, namely proving that the integration of peer feedback in microteaching is effective in strengthening the pedagogical competence and self-confidence of prospective physics teachers. The results of this study have strategic implications for physics education. First, the systematic integration of peer feedback into microteaching lectures can improve the quality of mastery of basic physics teaching skills, especially in explaining abstract concepts, managing experiments, and guiding discussions based on scientific phenomena. This is relevant to the challenges of modern physics education that require adaptive and reflective teachers. Second, increasing the self-efficacy of prospective physics teachers impacts mental readiness, courage to innovate, and resilience in facing classroom dynamics. Recent research shows that practical experience supported by peer collaboration can strengthen prospective teachers' self-confidence and

professionalism in the context of science learning. Therefore, peer feedback is recommended as an integral part of the physics teacher education curriculum to develop competent, reflective educators who are ready to face the challenges of 21st-century learning.

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Conflict of Interest

The authors declare that they have no conflict of interest related to this study.

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Author Contributions

F.F., F.K., L.L., R.D.D.P., A.M., K.F., E.S., U.M., I.Y., N.E.S., and A.A.P. contributed to the research and manuscript preparation. All authors contributed to the development or implementation of the study, reviewed and approved the final version of the manuscript, and agreed to be accountable for their respective contributions.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to applicable confidentiality and ethical considerations.

Ethics Approval and Consent to Participate

The study was conducted with the participation of undergraduate students enrolled in the Physics Education Study Program at Universitas Sains Al-Qur'an. The research was carried out in accordance with applicable ethical principles for research involving human participants. Formal ethical approval was not obtained. Participation was voluntary, and informed consent was obtained from all participants before data collection.

Generative AI Declaration

The authors did not use generative artificial intelligence (AI) tools in the preparation of this manuscript.

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