



Profile of Physics Teacher Candidates' Teaching Skills in Microteaching Course with Project-Based Learning

Derlina^{1*}, Wawan Bunawan¹, Sabani¹

¹Department of Physics, Faculty of Mathematics and Sciences, Universitas Negeri Medan, Medan, Indonesia.

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Corresponding Author:

Derlina

derlina@unimed.ac.id

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Abstract: This study aims to analyze the improvement of teaching skills of prospective physics teachers in Unimed Physics Education Study Program. The research method used is classroom action research method with Kemmis and Mc. Taggart model by applying project-based learning model in microteaching course. The research stages consist of planning, action, observation and reflection. The research subjects were 2020 batch students who took microteaching courses in the even semester of 2022/2023 year academic as many as 10 people. This research consists of 3 cycles with 2 meetings in each cycle. The instruments used in this study were questionnaires, teaching skills assessment rubrics and learning observation sheets. Data collection was carried out by giving questionnaires and direct observation of learning activities carried out by prospective teacher students. Data analysis techniques were carried out with gain test analysis. The average score of prospective teachers' teaching skills at the time of cycle 1 was 36.9 in the very unskilled category, to 81.6 in the skilled category in cycle 3, experiencing an increase in scores from cycle 1 to cycle 3 with an N-gain score = 0.7 in the moderate category. Based on the results of the study, it can be concluded that project-based learning in microteaching courses can improve the teaching skills of prospective physics teachers in microteaching courses.

Keywords: Microteaching; Project based learning model; Teaching skills

Introduction

The development of the industrial revolution 4.0 and the occurrence of the covid-19 pandemic which attacked all countries in the world including Indonesia have had a significant impact on all aspects of human life including the educational aspect. In the field of covid-19 education, it has brought a new dimension, especially in terms of aspects of organizing education (Asmuni, 2020). Efforts made by the government to suppress the spread of the covid-19 virus in the field of education are by implementing a learning from home policy (Anugrahana, 2020; Astini, 2020; Oktawirawan, 2020).

Online learning at the university level is carried out by utilizing online learning applications that have been provided by each university (Cahyani et al., 2020). The implementation of online learning is also applied to all courses including microteaching courses. Microteaching courses are courses that are carried out to be able to provide real teaching experience by providing a number

of teaching skills before students go to school (Hikmawati et al., 2020). Microteaching is a teaching practice in a small scope, with the number of participants ranging from 5 to 10 people, the classroom is limited, the implementation time ranges between 10 and 15 minutes, focuses on certain teaching skills, and the subject matter is simplified (Arsil, 2017). In micro teaching, students as prospective teachers are prepared to be able to face the work of teaching fully in front of the class by having the knowledge, skills, skills and attitudes of a professional teacher. Microteaching is a cyclical method designed in such a way as to improve the teaching skills of prospective teachers and or develop teacher professionals, especially teaching skills by simplifying or minimizing aspects of learning such as the number of students, time, focus of teaching materials and limiting the application of certain teaching skills so that the strengths and weaknesses contained in the learning carried out by prospective teachers can be identified accurately focused on certain teaching skills.

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To train students to become professional prospective teachers, a field introduction learning process is needed, but previously micro-learning was carried out to train basic teaching skills (Azrai et al., 2020). Microlearning has proven to be an effective diagnostic tool for identifying the specific needs of student teachers and a preparation tool for real-life placements or real schools (Ledger et al., 2020). In the micro learning process, students are introduced to eight basic teaching skills consisting of questioning skills, reinforcement skills, variety skills, explaining skills, opening and closing skills, small group discussion skills, class management skills and small group teaching skills (Nurhikmayati et al., 2020; Rezanita et al., 2020; Sufiati et al., 2019).

Physics Education Study Program as a professional teacher education institution is responsible for producing professional teachers including pedagogical competence, professional competence, social competence, and personal competence with soft skills in the 21st century. Microteaching is one of the courses that must be attended by prospective teacher students to equip students to have teaching skills, have the skills to design and implement learning that is relevant to current conditions. However, the rapid changes in the times that coincide with the covid 19 pandemic have caused learning conditions in schools to undergo many changes from conventional learning full face-to-face in the classroom to learning in today's digital era which is carried out in various ways, namely face-to-face, online or blended learning. This causes microteaching learning if it is still carried out as it has been done so far to be irrelevant so that it needs to be reorganized. In response to this, researchers designed a study to remodel microteaching course learning by implementing project-based learning. Rearrangement of learning tools and implementation of microteaching courses so that prospective teacher students have teaching skills that are relevant to the competencies of teachers needed in the 21st century based on the demands of learning in the era of the Industrial Revolution 4.0. The application of learning models adapted to 21st century learning is very important to provide learning experiences to students (Maksum et al., 2022; Viyanti et al., 2023).

Project-based learning is learning that trains students to apply their understanding in real-life situations by working on a project task (Lidi et al., 2021; Mulyaningsih et al., 2021). Some previous studies related to project-based learning have found that project-based learning can improve student learning outcomes and concept understanding and can improve students' critical thinking skills because it can motivate students by carrying out interesting and challenging project tasks (Nusa, 2021). Furthermore, it states that

project-based learning allows students to have the ability to learn independently by planning projects together with the group to produce a work product that can be presented to other participants. There are several benefits that can be obtained by implementing project-based learning, including being able to improve students' ability to solve learning problems, make students more active by completing projects in the form of real tasks, and students can evaluate the projects they work on themselves (Mujiburrahman et al., 2023). The results of other research specifically conducted in microteaching courses state that project-based learning can improve the teaching skills of chemical education students during the covid 19 pandemic which is full of limitations (Habibi et al., 2019).

Method

This research was conducted in the Physics Education Study Program, Department of Physics, FMIPA, State University of Medan on 2020 batch students totaling 10 people in the even semester of the 2022/2023 academic year. The type of research is classroom action research with the Kemmis & Taggart model, which is in the form of a spiral from one cycle to the next. Each cycle includes planning, action, observation and reflection. The research cycle of PTK model Kemmis and Mc. Taggart model as shown in Figure 1.

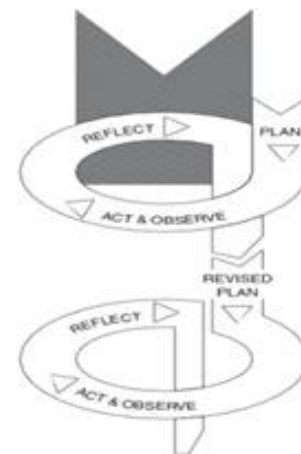


Figure 1. PTK cycle of Kemmis & Mc. Taggart

The planning step involved initial identification to explore and determine the causes of the problem. The results of discussions with the course teaching team agreed to implement project-based learning. The implementation step is for students to make a project task, namely making a learning video about teaching skills. In the observation step, students carry out teaching skills learning practices, then are commented on by lecturers and peers. The reflection step is carried

out to improve and refine the project based on input and comments from observers.

Data collection techniques were carried out by administering questionnaires and observations. Instruments to measure student teaching skills used observation assessment sheets for 8 teaching skills. Data on the development of student teaching skills were analyzed by the gain score test based on the equation 1 (Hake, 2002).

$$N \text{ Gain} = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Ideal Score} - \text{Pretest Score}} \quad (1)$$

The criteria for the N - Gain category are as in Table 1.

Table 1. N-Gain Categories (Meltzer, 2002)

Category	Point Gain
High	$g > 0.7$
Medium	$0.3 < g \leq 0.7$
Low	$g \leq 0.3$

Data description of student teaching skills was carried out with the concept of Miles and Huberman, namely data reduction, data appearance and conclusion drawing (Sugiyono, 2010). The average results of the teaching skills scores are summarized as Table 2.

Table 2. Criteria for Teaching Skills

Average Score	Criteria
85-100	Highly Skilled
70-84	Skilled
55-69	Less Skilled
40-54	Very Less Skilled

Result and Discussion

This study aims to describe the improvement of 8 basic teaching skills of prospective physics teachers in microteaching courses in the Physics Education Study Program at Unimed with the implementation of a project-based learning model. After that, students are given a project in the form of making a learning video which contains the teaching skills used. Students are asked to create a scenario to create a project that will be done. Including determining the material, determining the media to be used.

In the planning step, researchers gave questionnaires to students who had taken microteaching courses to get data about student needs about microteaching learning, then conducted focus group discussions by a team of lecturers teaching the subject to determine the Semester Learning Plan for microteaching courses. The results of the team discussion agreed that microteaching lectures were carried out with project-based learning. Students are given the task of making a learning video about teaching skills.

In the implementation step, students present their project assignments by practicing learning about teaching skills. Students conduct learning with 5 to 10 minutes with limited skills. Furthermore, lecturers and peers provide comments and feedback on practicing students. This feedback and comments are then used as a basis for revising the project.

The observation step lecturers and peers observe the learning carried out by the practitioner using the teaching skills observation sheet, then provide comments and feedback on the student practitioner. In the reflection step, students revise their project tasks based on comments and feedback from lecturers and peers.

The description of data on student teaching skills consists of data in cycle 1, namely data on teaching skills when practicing students 1. Cycle 2 data, namely data after students are given comments and feedback by lecturers and peers, cycle 3 data, namely final data after being given comments and feedback by lecturers and peers during cycle 2. The results of the study obtained a questioning skill score of 85 (highly skilled category); lesson opening skill score 83 (skilled category); The skill score for closing the lesson was 80 (skillful category); the skill score for giving reinforcement was 85 (very skillful category); the skill score for making variations was 85 (very skillful category); the skill score for explaining was 80 (skillful category); the skill score for managing the class was 80 (skillful category); the skill score for guiding individual and small group discussions was 75 (skillful category). The average score of teaching skills of prospective student teachers at the time of cycle 1 was 36.9 in the category of very less skilled, at the time of cycle 3 was 81.6 in the category of skilled, experiencing an increase in scores from cycle 1 to cycle 3 with N-gain score = 0.7 in the medium category. The teaching skills scores of physics teacher candidates in cycles 1, 2 and 3 are shown in Table 3.

Table. 3. Physics Teacher Candidate Teaching Skill Score

Skill Component	Cycle 1 Score	Cycle 2 Score	Cycle 3 Score
Ask	30	65	85
Opening the Lesson	45	65	83
Closing the Lesson	40	70	80
Giving Reinforcement	30	70	85
Providing Variation	40	65	85
Explaining	30	65	80
Managing the Class	40	60	80
Guiding Group discussion	40	60	75
Average	36.9	65	81.6

The low score of student teaching skills in cycle 1, due to the fact that students carry out learning practices tend to carry out learning practices conventionally, not fully referring to the indicators that should be displayed for each component of teaching skills. There are some indicators that do not appear, there are also vague activities that cannot be observed during learning practices.

After being given comments and input on the learning practices carried out by lecturers and peers in cycle 1, students then revised the learning practice scenarios by really focusing on the skill indicators of each skill component that must be displayed in cycle 2 learning practices. Based on the results of observations of learning practices in cycle 2, then revised learning practice scenarios are continued with learning practices again in cycle 3. For those who have obtained a minimum teaching skill score of 70 are advised to record their learning and record this learning video uploaded to YouTube so that it can be used as a reference for microteaching learning.

Based on Table 3, the results of this study indicate that microteaching learning with a project-based learning model through project assignments to make learning videos can improve the teaching skills of prospective physics teachers. This is in line with the results of research (Habibi et al., 2019; Lidi et al., 2021; Mulyaningsih et al., 2021). Project-based learning is an innovative learning to develop teaching skills and increase student activity in learning. The results of the study (Kusumaningtyas et al., 2023; Mursid et al., 2022; Rahayu et al., 2023) found that the application of the project-based learning model had an effect on students' creative thinking skills in completing a project task. Suwarno et al. (2020) also stated that project-based learning models can not only improve students' understanding of concepts but can also develop basic skills needed to be able to adapt to everyday life such as decision-making skills, creativity, learning outcomes and problem-solving skills in this case including teaching skills. Ergül et al. (2014), Suryandari et al. (2018), and Widiana et al. (2021), state that project-based learning is a learning model that facilitates students to actively participate in learning, making students responsible and independent in solving learning problems. The project-based learning model is not only concerned with the final project, but emphasizes more on the process of how students solve their problems by completing a project task. This approach makes students gain invaluable experience by actively participating in working on their projects. The implementation of project-based learning models can develop students' general skills such as innovating project tasks, discussing and cooperating in and being responsible for

completing their project tasks (D. Susanti et al., 2020, 2022).

Increasing the score of teaching skills of prospective physics teachers in project-based microteaching learning with stages ranging from determining problems and questions that must be resolved to designing and evaluating projects designed to increase student activeness in learning so as to improve the teaching skills of prospective teachers. Student activity can be seen from the efforts made by students so that the design and practice of their teaching skills are better, more interactive and the percentage of providing comments and input to friends who are practicing is also increasing, discussions run interactively and do tasks full of responsibility. The results of this study are also in line with the results of research by Wumu et al. (2023) which states that learning with various learning activities that solve problems can improve students' thinking skills. Project tasks facilitate student teachers to provide ideas, opinions and ideas openly and freely in completing project tasks. Aprida et al. (2023) also found that project tasks provide opportunities for students to freely provide ideas, ideas and opinions in working on tasks through the stages of designing, solving problems, conducting investigations so that they become more creative in completing project tasks that must be completed. Making learning video products can stimulate student creativity in creating a product (Kurniahtunnisa et al., 2023; Yustina et al., 2020). Project-based learning with the task of making learning videos uploaded to YouTube increases student motivation and enthusiasm for learning, students feel excited and challenged to design and implement better learning practices. These results are in line with the results of research (Nuramalina et al., 2022; Sumarni et al., 2020; D. F. Susanti et al., n.d.) which state that project-based learning models can increase student learning motivation.

Comparison of the scores of each teaching skill of prospective physics teachers can be seen in Figure 2.

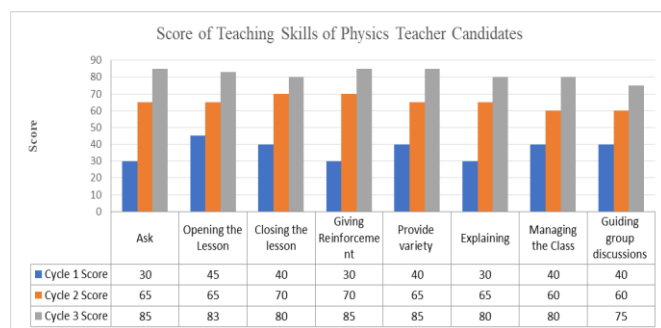


Figure 2. Comparison of teaching skill component scores

The criteria for improving teaching skill scores (N-Gain score) from cycle 1 to cycle 3 for each teaching skill component can be seen in Table 4.

Table 4. Criteria for Improvement of Teaching Skill Scores

Components of Teaching Skills	N-Gain Score	Desc.
Ask	0.8	High
Opening the Lesson	0.7	Medium
Closing the Lesson	0.7	Medium
Giving Reinforcement	0.8	High
Providing Variation	0.8	Tinggi
Explaining	0.7	Medium
Managing the Class	0.7	Medium
Guiding Group discussion	0.6	Medium
Average	0.7	Medium

The data in Table 4 shows that there is an increase in the score of prospective teachers' teaching skills with the implementation of the project-based learning model, the highest score increase is in questioning skills, skills to provide reinforcement and skills to make variations (N-Gain high category), for N-Gain other skills are in the medium category.

The average score of the questioning skills component in cycle three is 85, thus it can be stated that students already have good questioning skills. Students' skills in asking questions are indicated by several things, including students asking questions that are relevant to the students' level of education, namely high school students who like language and slang terms according to their age. Students' skills in distributing are good, but there is a tendency for students to immediately ask other students to answer the questions posed without responding or commenting on the answers of students who answer first, so there is confusion for students who will answer whether students are asked to answer the question again because the previous student's answer is wrong, incomplete or imperfect. This condition almost occurred in each student who practiced in cycle 1.

For the skill component of opening lessons, there was an increase in scores from the initial cycle of 45 (very unskilled category) to 83 (skilled category) in the final cycle. The skill of opening this lesson aims to focus students' attention and thoughts on the learning activities to be carried out. Students with various stories enter the classroom so that they do not have attention and have not focused on the things to be learned, this is where the need for a prospective teacher to practice the skills of opening lessons, so that the variety of thoughts in the minds of students is properly focused on learning activities. There are several techniques that prospective teachers use to focus students' minds and attention, among others, by showing the relationship between the subject matter to be learned and previous related

material. In showing the relevance of this material, there is something that is not right done by prospective teachers, namely linking the subject matter with the material previously studied according to the syllabus at the previous meeting, even though it does not always have to be linked to the material of the previous meeting, it can be with the materials of the meeting some time or a few weeks from the meeting the material is studied, but it must still be linked to the material of the previous meeting. In addition, teacher candidates also conducted apperception activities to open the lesson by asking quizzes, posing problems related to the material, asking students to tell their experiences, making games and watching short videos. The results of the observation show that the playback of this learning video is very liked by students, thus it is effectively used to focus students' attention and thoughts on the learning activities to be carried out. The delivery of learning objectives at the beginning of learning has been carried out by prospective teachers, but the delivery of these objectives tends to be read by prospective teachers in a letter late, which should be conveyed contextually. The results are in line with the results of research (Indraswati et al. (2023) which states that the learning objectives have not been fully conveyed to students and the apperceptions carried out are also not contextually less related to students' daily experiences.

The average score of closing skills in cycle 1 was 40 (less skillful category) to 80 (skillful category) in cycle 3. At the beginning of the prospective cycle, teachers tended to close the learning without reviewing the learning, only giving homework assignments to students. In real learning conditions at school, the same thing is often done by teachers, where as soon as the bell rings the teacher immediately completes the lesson without first reviewing the material (Habibi et al., 2019). The technique of closing the learning has varied, namely by doing activities asking students to summarize and make conclusions, giving reinforcement to students' summaries, reviewing students' understanding of physics material, and giving varied homework not only in the form of tests.

The score of teaching skills of prospective physics teachers in the skill component of giving reinforcement in the initial cycle was 30 and in the final cycle was 85, experiencing an increase in the high category after carrying out project-shaped assignments through the design of learning video assignments. There are several activities carried out by the teacher, namely giving verbal and non-verbal reinforcement. Verbal and non-verbal reinforcement is adjusted to the current conditions such as giving stickers, applause, thumbs up, smart and so on.

The score of the skill component of organizing variations of prospective physics teachers has a skillful category. The average score of skills in organizing variations in cycle 1 was 40 (less skillful criteria) to 85 (skillful criteria) in cycle 3. Variations in the use of media can already be shown by showing learning videos, virtual laboratories and educator activity sheets (LKPD). Variations in teacher teaching positions in cycle 1 teacher candidates tend to be in front of the class, but with the variation of learning media used, the variation in the position of teacher candidates is not only in front but can reach the entire room because they want to monitor students when working on LKPD or watching learning videos. Furthermore, the variation of teaching interactions of prospective teachers is not only from teacher to student or vice versa but there is interaction among students with discussion activities in completing the LKPD. Project-based learning that asks prospective teachers to make lesson plans that activate their students in learning can increase the teaching skills score of prospective teachers.

The score of the skill component of explaining physics teacher candidates had an average of 30 (very unskilled category) in cycle 1 to a score of 80 (skilled category) in cycle 3. Explaining skills aim to make students understand the subject matter, involve students in expressing their ideas and ideas and develop students' cognitive structure. Explanation skills of physics teacher candidates are good, which can be seen from the indicators of giving explanations tailored to the age of students, prospective teachers provide examples and illustrations contextually in accordance with students' daily experiences. The explanation given is adjusted to the objectives and characteristics of learning, making the explanation meaningful to students.

Classroom management skills are efforts made by teachers to condition the classroom in such a way as to Agustina et al. (2017) carry out the learning process effectively and efficiently. The results of data analysis obtained the score of classroom management skills at the beginning of the cycle was 40 (less skilled category) to 80 (skilled category) at the end of the cycle. The skills of prospective teachers in selecting teaching materials that are relevant to learning objectives can be achieved, although not fully accommodated. The enthusiasm of prospective teachers in responding and responding to questions asked by students is quite good, because prospective teachers tend to like it when students ask and respond. In terms of time utilization, it still needs to be improved.

The skill of guiding small group discussions is a skill needed in learning by providing opportunities for students to discuss in groups in solving a problem. This skill has been owned by prospective physics teacher

students. This is shown from the increase in score 40 in cycle 1 to score 75 in cycle 3. In connection with the learning practice of guiding small group discussions, at first it did not make students discuss, this is because the LKPD designed by prospective teachers is in the form of closed LKPD where students are only asked to write down definitions or formulas so that to solve this, students are not challenged to argue to convey their ideas and opinions. After receiving input from lecturers and peers, teacher candidates can finally design LKPDs that are open, namely LKPDs whose answers are not directly stated in several available sources but are implied so that they require different thoughts and perceptions that force students to discuss.

Conclusion

Based on the results of data analysis, it shows that there is an increase in the average score of teaching skills of prospective teachers with project-based learning with N-gain score = 0.7 in the medium category. It is concluded that project-based learning in microteaching courses can improve the teaching skills of prospective physics teachers in microteaching courses.

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Author Contributions

The research team contributed to the writing of this scientific work, namely: Derlina; idea and conception; data collection: Sabani; analysis and interpretation of results; Bunawan, W.; drafting of manuscript: Derlina, Sabani. The writing team analyzed the research results and agreed on the final draft of the manuscript.

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Conflicts of Interest

The authors whose names appear below declare that they have no affiliation with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consulting, stock ownership, or other equity interests; and expert testimony or patent licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript.

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