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Examining preservice mathematics teachers' basic teaching skills in technology-integrated microteaching

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ABSTRACT

The background of this research is based on previous studies that emphasize the importance of mastering basic teaching skills for prospective teachers to support effective learning. The purpose of this study was to explore undergraduate students' basic teaching skills in managing mathematics classes through microteaching activities. This study employed a case study method involving 29 undergraduate preservice teachers from the second cohort of the Mathematics Education Study Program. Data were analyzed through triangulation of primary literature on teaching skills, classroom observations, and microteaching document studies. The reconstruction of the Outcome Based Education (OBE) curriculum produced a course titled Innovative Learning Design, which includes outputs in the form of learning tools, microteaching sessions, and microteaching videos. The findings revealed that all basic teaching skills were performed satisfactorily. The most prominent skills were opening and closing lessons and using technology-integrated media. In contrast, the least evident skills were explaining and providing reinforcement, as some preservice teachers had not yet mastered prerequisite or fundamental mathematics concept. Based on these findings, it is recommended that future research analyze the influence of basic teaching skills on student learning outcomes and active student engagement in class.

KEYWORDS

Teaching skills; learning mathematics; technology; mathematics education students

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INTRODUCTION

It is important for educational institutions to produce graduates who not only possess a strong theoretical understanding but are also able to apply their knowledge practically in various professional contexts (Simangunsong, 2023). For instance, in lectures, prospective mathematics teachers acquire knowledge related to pedagogical content (Muhyidin et al., 2022), numeracy (Ayuningtyas & Sukriyah, 2020; Nadjamuddin & Hulukati, 2022), basic teaching skills (Daulay et al., 2023; Pasangka & Pahnuel, 2021; Rusmaini, 2019), curriculum implementation (Ikemoto et al., 2016; Miller-Rushing & Brasili, 2024; Zahroh et al., 2023), technology integration in learning (Le Pichon et al., 2024) and the development of learning materials aligned with the current curriculum (Hasanah & Siregar, 2022; Novita et al., 2021).

The curriculum implemented for undergraduate students follows the Outcome-Based Education (OBE) framework, which emphasizes the achievement of specific and measurable learning outcomes. These outcomes are designed to ensure that students acquire competencies



relevant to professional practice. OBE focuses on measuring the skills and competencies required for success in the workplace and for contributing effectively to society. As of June 2024, one of the main challenges faced by the study program is aligning the content of pedagogical course syllabi, as agreed upon by the faculty, with the expected learning outcomes of students. One such course is *Innovative Learning Design*, whose syllabus emphasizes the concepts and theories of innovative learning tools. However, the OBE-based curriculum should not only focus on conceptual understanding but also emphasize its application in everyday educational contexts (Salvaña & Costelo-Abrea, 2021).

The implementation of the OBE curriculum also requires educators to develop effective basic teaching skills. These include the ability to design and deliver structured learning materials, apply innovative and responsive teaching methods, and manage learning effectively to maximize learning outcomes (Nasution, 2015). Basic Teaching Skills (BTS) refer to pedagogical competencies that enable teachers to design, implement, and evaluate learning effectively, as well as to manage the classroom environment to create an engaging and enjoyable learning experience. Key aspects of BTS include the ability to plan clear and relevant lessons, present varied and interesting materials, ask questions that promote critical thinking, manage group discussions, and provide appropriate evaluations (Cohen et al., 2010). Learning is considered effective when teachers can foster students' self-development and encourage active participation in problem-solving (Deviana & Aini, 2022; Macqual et al., 2021; Shaughnessy et al., 2021; Wang, 2014).

Despite its benefits, several challenges remain in implementing the OBE curriculum in mathematics education at the research site. Prospective mathematics teachers, who are undergraduate students prior to entering a teacher professional program, need to master basic teaching skills effectively. This aligns with previous research indicating that students often struggle to apply BTS during microteaching sessions (Robiah, 2015). One contributing factor is that in pedagogical courses preceding microteaching, students have limited opportunities to practice these skills (Mujais et al., 2019).

At the university where this study was conducted, BTS has traditionally been taught theoretically without microteaching practice. BTS is one of the topics covered in the *Learning Strategies* course in the second year of the undergraduate program. Based on an interview with one of the lecturers teaching this course in 2024, students were typically asked to conduct independent literature searches and present BTS theories without any hands-on practice. Furthermore, during the *Introduction to School Field* course in the third year,



students often encountered difficulties in classroom management and in delivering materials effectively. This finding is consistent with prior research indicating that preservice teachers serving as model teachers often struggle to manage classrooms and lack mastery of subject matter, resulting in ineffective communication of mathematical concepts (Awaliyahputri, Syamsudduha, & Shabir, 2019). Interviews with students in this study revealed similar experiences, indicating that the absence of courses designed to train BTS led to difficulties in managing classroom learning environments during teaching practice, often resulting in disorganization and reduced student engagement (Mujais et al., 2019). Previous research also emphasized the need for explicit inclusion of teaching practice and BTS training in course curricula to ensure that preservice teachers are well-prepared and competent during school-based teaching experiences (Robiah, 2015).

The research gap addressed in this study arises from earlier findings that highlight the importance of mastering basic teaching skills before participating in school teaching practice (Cohen et al., 2010). BTS mastery is found to be more effective when practiced directly and integrated into instructional planning (Sugihartini et al., 2020). However, in the current context, BTS has been taught theoretically in class without practical implementation, limited to presentations and discussions. This study also aligns BTS classifications with the OBE curriculum to ensure that the competencies assessed correspond to the BTS framework—an aspect not detailed in previous studies (Wragg, 2006). Since the OBE curriculum had not yet been fully implemented at the research site, it was first necessary to reconstruct the curriculum by emphasizing learning outcomes that include practical components such as lesson plans and microteaching reports. Previous studies have also acknowledged a lack of curriculum reconstruction as a limitation in their research (Felder, 2011). This study aims to conduct an in-depth exploration of the basic teaching skills required by undergraduate students in alignment with the implementation of the Outcome-Based Education (OBE) curriculum. The research problem is formulated as follows: How is the OBE curriculum reconstructed in the *Innovative Learning Design* course? 1) How are basic teaching skills implemented during microteaching activities? 2) To address these research questions, this study presents the results of the curriculum reconstruction in the *Learning Strategy* course and the outcomes of microteaching implementation based on Basic Teaching Skills (BTS) demonstrated by students. In the previous curriculum, the *Learning Strategy* course was conducted theoretically, requiring students to present the results of literature-based discussions on BTS. In contrast, the reconstructed OBE curriculum, implemented through the



Innovative Learning Design course, focuses on practical outcomes in the form of lesson plans and teaching practice (microteaching) activities.

METHODS

This study employed a qualitative approach using exploratory research design (Creswell, 2014) aimed at obtaining data on the basic teaching skills demonstrated by students, both through learning instruments and instructional videos produced as outputs of the OBE curriculum. The qualitative approach involved analyzing data derived from observations and documentation of exploration processes that occurred during the study.

Data collection was conducted through document analysis and observation. The document analysis focused on the results of Focus Group Discussions (FGDs) related to curriculum reconstruction and documentation of Basic Teaching Skills (BTS) observed during microteaching sessions. The document study addressed the first research question by presenting data in a detailed, systematic manner, supported by relevant evidence (Creswell, 2014). Observations were carried out during microteaching activities, focusing on students' gestures and their alignment with the prepared learning tools (Cohen et al., 2010). The BTS observations supported the second research question regarding students' competency in managing classroom learning.

This research was conducted at the university level and involved 29 undergraduate students from the Department of Mathematics Education—referred to in this study as *undergraduate preservice teachers* (hereafter called “students”). The selection of the research site was based on the needs analysis and issues identified through the researchers' prior teaching experiences. Additionally, the site was chosen due to its adequate facilities and infrastructure to support microteaching activities.

The research subjects were determined using purposive sampling, selected based on the relevance of their involvement in implementing BTS. According to (Creswell, 2014), purposive sampling involves selecting participants who meet specific criteria aligned with the research objectives. In this study, participants were students enrolled in the *Innovative Learning Design* course and preparing to undertake the *School Field Introduction Program* (PLP). The observation targets were second-year (2022 intake) students who had completed the *Innovative Learning Design* course and were participating in microteaching sessions.

The study consisted of three stages, beginning with the identification of problems and concluding with the formulation of findings. The final research outcomes focused on conceptualizing the implementation of the OBE curriculum, emphasizing the integration of



Basic Teaching Skills in both written learning instruments and verbal demonstrations in microteaching videos. The research procedure that is found in Figure 1 is detailed as follows.

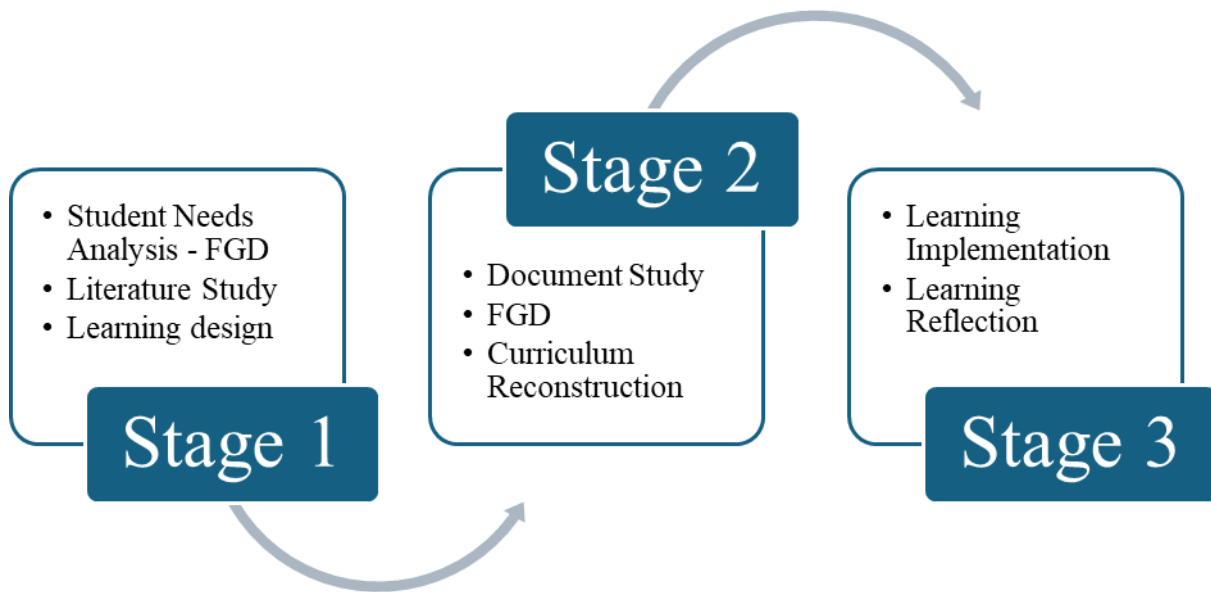


Figure 1. The Research Procedure

Stage 1

Within this stage there are three phases. The phases are detailed as follows.

1. Student Needs Analysis

This stage aims to identify and analyze student needs to be addressed as outputs of the course. The needs analysis was carried out through interviews with third-year undergraduate students in the form of a *Focused Group Discussion (FGD)* involving mentor teachers from the *Introduction to School Field* program and field supervisors (DPL). The main focus of the discussion was students' basic teaching skills.

The output of this activity was an FGD report emphasizing the implementation of the *Introduction to School Field* program in schools, the challenges faced by students, and the learning tools they prepared. The report was then narrated and summarized to support the analysis of student needs (T. Nasution et al., 2023) in learning *Innovative Learning Design* prior to the implementation of the *Introduction to School Field* program.

2. Literature Study

The literature study aimed to gather information from previous research published in academic journals. Relevant research articles were identified using the online databases Scopus and Google Scholar. The keywords used included *OBE curriculum, implementation of*



OBE curriculum, basic teaching skills, and the basic teaching skills.

The output of this activity was the development of a state-of-the-art table that highlights the similarities, differences, and novelty of this study compared with previous research.

3. Learning Design

The learning design stage aimed to develop a course syllabus along with supporting documents as part of the curriculum reconstruction process. The redesign process included preparing the course syllabus according to the study program's standard template and developing appropriate learning evaluation instruments.

Stage 2

Within this stage there are three phases. The phases are detailed as follows.

1. Document Study

The documents analyzed at this stage included the *Lesson Plan* for the *Innovative Learning Design* and *Microteaching* courses, as well as the curriculum guidebook of the Mathematics Education Department at a private university in Indonesia. These documents were examined by reviewing the learning outcomes, the sequence of lecture materials, course outputs, and the competencies achieved by students. The analysis was then compiled by presenting evidence from the course syllabus and evaluating its alignment with the components of Basic Teaching Skills (BTS) and the competencies expected as student outcomes.

2. Curriculum Reconstruction

The curriculum reconstruction stage aimed to develop and improve the existing curriculum through a series of targeted modifications. This process involved reviewing the study program's vision and objectives, course learning outcomes, and sub-learning outcomes. The reconstruction was further refined by aligning the findings from the student needs analysis report with the learning outcomes of each course. The output of this stage was a comprehensive *Curriculum Reconstruction Report*.

3. FGD

Focus Group Discussions were conducted by involving curriculum developers from the study program in accordance with their areas of expertise. The output of this activity was the development of a detailed course syllabus, along with the design of assignment formats and assessment criteria for course deliverables.



Stage 3

The third stage of this research involved implementing the lesson plans for the *Innovative Learning Design* and *Microteaching* courses. At this stage, lectures were conducted covering several core materials, as outlined in the process column. The fourth stage consisted of a learning reflection activity that engaged students acting as model teachers, students as observers, and lecturers as both observers and moderators of the reflection discussion. The topics discussed during the reflection sessions are presented in the process column.

Table 1. Research Implementation and Reflection

Learning Steps	Objective	Process	Output
Implementation of learning	To implement the course syllabus over 16 sessions, culminating in microteaching activities or learning simulations.	The course is conducted across 16 meetings, beginning with an orientation on the independent curriculum at the junior high and high school levels. Activities include analyzing mathematics learning materials, preparing infographics on disruptive learning situations, designing learning tools, conducting teaching simulations, and completing reflection sessions.	1. Mathematics learning materials and lesson plans 2. Infographics on disruptive mathematics learning situations and strategies for handling them 3. A 15-minute learning video uploaded to YouTube
Learning reflection	The purpose of the learning reflection is to analyze the strengths, weaknesses, challenges, and follow-up actions of the learning process.	Reflection is conducted through group discussions between lecturers and students, using a learning reflection sheet. The sheet includes aspects such as learning strengths and weaknesses, teaching challenges, future improvement plans, preferred learning activities, distinctive teacher gestures, and the alignment of lesson implementation with the teaching module.	A reflection report compiled based on class discussion and mutual agreement.

Based on [Table 1](#), the research implementation consisted of 16 meetings with students, with examinations conducted during the 8th and 16th sessions. The curriculum reconstruction results, which produced a revised lesson plan, were implemented through the following



materials: 1) orientation on the independent curriculum for schools, 2) explanation of the various mathematics learning tools, 3) discussion and creation of disruptive learning posters, 4) Design of learning tools, and 5) Microteaching activities. The implementation concluded with a learning reflection activity, conducted in the form of discussions addressing the strengths and weaknesses of the learning process, challenges encountered by model teachers, plans for follow-up learning, teacher gestures, and the alignment between the implemented lessons and the prepared learning tools. The reflection discussions involved model teachers, student observers (peers), and lecturers who acted as both observers and discussion moderators. The targeted achievement indicators and research instruments used in this study are presented in [Table 2](#).

Table 2. Targeted achievement indicators and instruments used

Learning Stages	Targeted Achievement Indicators	Research Instruments
Student Needs Analysis	Student needs are identified and accommodated through written reports.	Interview guidelines
Literature Study	The state of the art is organized and presented in a tabular format.	State of the art table
Curriculum Reconstruction	The OBE-based curriculum design is developed for the Innovative Learning Design course in the form of a Semester Lesson Plan.	Curriculum Reconstruction report
Learning Design	Structured learning tools are developed	Course syllabus Worksheet Learning simulation assessment rubric
Implementation of learning	1. Conductiong pros and cons discussions on disruptive activities in mathematics learning 2. developing mathematics learning tools 3. Implementing learning simulations 4. Producing learning videos	Observation sheet
Learning reflection	Preparing a learning reflection report and follow-up plan	Learning reflection report

RESULT AND DISCUSSION

This section conveys and discusses the findings from the data collected in the three stages of this study.

Stage 1: Focus Group Discussion as the Needs Analysis

The student needs analysis was conducted with 29 students from the Mathematics Education Study Program at a private university in Indonesia (M). Focus group discussions



(FGDs) were held with several students representing different skill categories in developing teaching modules. In addition, FGDs were also conducted with Supervising Teachers (GP) and Field Supervisors (DPL) involved in the students' *Introduction to School Field* activities. The description of the FGD participants is presented in Table 3.

Table 3. Description of FGD Members

Members	Educational Level/ Institution	Skill Level in Preparing Teaching Modules	Length of teaching (years)	Experience in Guiding Fieldwork (years)
M1	Student's University	Low	-	-
M2	Student's University	Intermediate	-	-
M3	Student's University	High	-	-
GP1	Teacher at secondary school	-	13	10
GP2	Teacher at high school	-	17	14
DPL	Lecturer	-	14	11

Based on Table 3, demographically, the selected subjects were categorized according to their basic skills in preparing teaching modules, teaching experience, and experience in supervising Field Professional Programs. M1, M2, and M3 are students who have participated in *Introduction to School Field* activities, which focus on familiarizing students with school culture at the junior high and senior high school levels.

No	Deskripsi Kegiatan	Waktu	Translation:
1	Kegiatan Awal 1. Guru memberikan salam dan bersama-sama dengan peserta didik berdoa sebelum pembelajaran dimulai. 2. Guru mengecek kehadiran peserta didik. 3. Guru menyampaikan tujuan pembelajaran saat ini: - peserta didik dapat menentukan penyelesaian SPLDV dengan metode eliminasi.	15 menit	1. Initial Activities • The teacher greets the students and leads a prayer before the lesson begins. • The teacher checks students' attendance. • The teacher communicates the learning objective for the lesson: <i>students are able to determine the solution of a system of linear equations in two variables using the elimination method.</i>
2	Kegiatan Inti Melalui Pendekatan saintifik dengan model Problem Based Learning : 1. Guru meriview kembali materi pada pertemuan sebelumnya yaitu tentang persamaan linear dua variabel. 2. Guru meminta peserta didik agar menempatkan diri pada kelompok sesuai dengan kelompok belajar pertemuan sebelumnya. 3. Peserta didik diberikan sebuah permasalahan di LKPD yang berisi tentang penyelesaian SPLDV menggunakan metode eliminasi. 4. Peserta didik mengerjakan LKPD tersebut dengan kelompoknya 5. Peserta didik mulai berdiskusi untuk menyelesaikan permasalahan terkait langkah penyelesaian SPLDV. 6. Peserta didik secara teratur mengemukakan hasil diskusi mereka. 7. Peserta didik saling menanggapi hasil diskusi dan membuat kesimpulan dari permasalahan yang diberikan.	60 menit	2. Core Activities Using a scientific approach and the Problem-Based Learning (PBL) model: • The teacher reviews the material from the previous session, which focused on linear equations in two variables. • The teacher asks students to form groups based on the study groups from the previous meeting. • Students are given a problem in the worksheet related to solving a system of linear equations in two variables using the elimination method.

- Students work collaboratively on the worksheet within their groups.
- Students discuss and solve problems following the steps for solving systems of linear equations in two variables.
- Students regularly present the results of their group discussions.
- Students respond to one another's presentations and draw conclusions from the given problems.

Figure 2. Lesson Plan in FGD Activity: Student A

The FGD results indicated that M1, M2, and M3 were able to compile complete and systematic teaching modules, as illustrated in Table 4. However, each demonstrated different



weaknesses: M1 developed a teaching module but did not include activities for apperception, motivation, reinforcement, and reflection (see Figure 2); M2 created a comprehensive teaching module but did not incorporate differentiated learning or the 4C components (creativity, critical thinking, collaboration, and communication) (see Figure 3); and M3 prepared a complete teaching module but did not include enrichment and remedial activities (see Figure 4).

E. Kegiatan Pembelajaran Kegiatan Belajar 1 (ATP 1-4) a. Kegiatan Awal - Guru memberi salam, menyapa peserta didik. - Peserta didik memimpin berdoa sebelum pembelajaran dimulai. - Guru menanyakan kabar peserta didik, perasaan peserta didik sebelum pembelajaran dimulai. - Guru mempresensi kehadiran peserta didik. - Guru menyampaikan tujuan pembelajaran tentang sistem persamaan linier dua variabel - Peserta didik diberikan pertanyaan berupa pertanyaan pemantik, agar peserta didik lebih berminat dalam melakukan pembelajaran dikelas. b. Kegiatan Inti Orientasi Masalah - Peserta didik diberikan gambar mengenai kegiatan ekonomi yaitu tentang membeli pulpen dan buku tulis. - Peserta didik diminta menentukan diketahui dan ditanya dari permasalahan yang telah diberikan. - Peserta didik diminta membuat model matematika dari permasalahan yang telah diberikan. Mengorganisasi Peserta didik - Guru membagi peserta didik menjadi 2 kelompok yang beranggotakan 3-4 orang. - Guru memberikan LKPD kepada masing-masing kelompok. - Peserta didik berdiskusi dengan kelompoknya terkait masalah yang diberikan. Membimbing Penyelidikan dan Mengumpulkan Informasi - Peserta didik mengumpulkan informasi dengan mengisi lembar LKPD - Peserta didik dengan kelompoknya melakukan penyelidikan terhadap informasi yang didapat untuk menentukan harga dari sebuah pulpen dan buku tulis.	Translation: 1. Learning Activity 1 a. Initial Activities - The teacher greets the students. - One of the students leads a prayer before the lesson begins. - The teacher asks the students how they are feeling before starting the lesson. - The teacher checks students' attendance. - The teacher communicates the learning objective related to systems of linear equations in two variables. - The teacher presents trigger questions to spark students' interest in the lesson. b. Core Activities Problem Orientation - Students are shown pictures of economic activities, such as buying pens and notebooks. - Students identify the known and unknown
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information from the given problems.

- Students create mathematical models based on the problems provided.

Organizing Students

- The teacher divides the class into two groups of three to four students each.
- The teacher distributes worksheets to each group.
- Students discuss the given problems within their groups.

Guiding Investigations and Collecting Information

- Students collect information by completing the worksheet.
- Working in groups, students investigate the obtained information to determine the price of a pen and a notebook.

Figure 3. Lesson Plan in FGD Activity: Student B

Kegiatan Akhir (±10 menit) - Guru dan peserta didik membuat kesimpulan dari keseluruhan pembelajaran yang telah dilaksanakan dan refleksi pembelajaran - Peserta didik diberikan tugas individu untuk mengetahui pemahamannya tentang barisan aritmatika - Guru menginformasikan pembelajaran yang akan dilaksanakan pada pertemuan berikutnya dan meminta peserta didik untuk mempersiapkan (terkait dengan deret aritmatika) - Guru menutup pembelajaran dengan doa bersama dan mengucapkan salam	Translation: Final Activities - The teacher and students draw conclusions from the entire lesson and reflect on the learning process. - Students are given individual assignments to assess their understanding of arithmetic sequences.
REFLEKSI PENDIDIK - Apakah tujuan pembelajaran tercapai? - Apakah peserta didik beraja secara aktif? - Apakah pembelajaran yang saya lakukan sudah sesuai dengan napa yang saya rencanakan? - Apakah media pembelajaran sudah sesuai dengan materi yang disampaikan? - Apakah LKPD sudah mencakup seluruh indicator pencapaian tujuan pembelajaran?	- The teacher informs students about the topic to be covered in the next meeting and asks them to prepare (related to arithmetic sequences). - The teacher closes the lesson with a joint prayer and farewell greeting.

Teacher Reflection

- Were the learning objectives achieved?
- Were students actively engaged in the learning process?
- Was the learning conducted in accordance with the lesson plan?
- Were the learning media appropriate for the material presented?
- Did the worksheet cover all indicators of the learning objectives?

Figure 4. Lesson Plan in FGD Activity: Student C



Based on [Table 3](#), from the students' perspective, there is a need for courses that allow them to practice teaching modules they have developed. The students stated that they still felt uncertain about implementing their compiled teaching modules and were not yet ready to apply them directly during the *Introduction to School Field 2* program.

Interviews with Supervising Teachers (GP1 and GP2) revealed similar insights. Both noted that during *Introduction to School Field 1*, students were able to analyze learner needs after conducting classroom observations. Excerpts from the interviews are presented below:

Researcher : How were the students' activities during Introduction to School Field 1?

GP2 : The students prepared complete and systematic lesson plans. However, although they did not appear nervous in class, they were not yet able to manage the classroom effectively, which made learning less conducive.

GP1 : That's correct. The students still need guidance and direction in managing the class and facilitating student discussions.

Students also reported that junior high school students require intensive guidance and engaging learning media that can be integrated with smartphones. Meanwhile, senior high school students prefer project-based learning, as it allows for more flexible learning environments and fosters a deeper understanding of the application of the material being taught

Both GP1 and GP2 agreed with the findings of the students' needs analysis, which was based on their teaching experiences. GP1 mentioned that students who had completed *Introduction to School Field 2* were generally not ready to teach independently and still required intensive guidance in implementing their teaching modules. In contrast, GP2 observed that while students during *Introduction to School Field 2* appeared more confident and less nervous when teaching, they still struggled to manage the classroom effectively, especially in less conducive conditions.

The Field Supervisor (DPL), who has experience mentoring *Introduction to School Field* students, expressed a similar opinion. According to the DPL, students in *Introduction to School Field 2*, which focuses on teaching practice, need opportunities to implement and refine their teaching modules through practical application. This view is supported by monitoring and evaluation reports, which indicate that students often report discrepancies between their teaching practice and the lesson designs outlined in their modules.

In terms of time management, students were found to have difficulty estimating and allocating time according to the planned learning activities. Based on these findings, it was concluded that students' needs in designing and implementing teaching modules include the following: 1. Students need regular practice in developing complete, systematic, and student-



centred teaching modules. 2. Students require teaching practice opportunities to observe the implementation of their teaching modules. 3. Students need to strengthen their fundamental teaching skills through guided practice.

These results are consistent with previous research, which emphasizes that mastering teaching skills is essential to create a conducive classroom environment and ensure optimal learning (MZ, Huda, & Kharisma, 2022).

Stage 2: Course Reconstruction as The Result of Curriculum Development

Based on the results of the course reconstruction, the *Learning Planning and Strategy* course was renamed *Innovative Learning Design*. The most significant change lies in the instructional approach, which shifted from problem-based collaborative learning to output-based learning. The expected output of the *Innovative Learning Design* course is a comprehensive teaching module and its supporting components, including teaching materials, worksheets, learning media, and learning evaluation instruments. The *Microteaching* course, however, underwent minimal changes.

These results align with previous studies emphasizing that effective learning tools should not be limited to lesson plans but also include teaching materials, worksheets, and evaluation instruments (Effendi, 2019; Mushtaq, 2012)

Stage 3: Research Implementation

Teaching practice was conducted three times using the Lesson Study (LS) approach. The class, consisting of 29 students, was divided into three groups randomly.

The *plan* stage was carried out through presentations and discussions on the teaching practice plans using the teaching modules developed in the *Innovative Learning Design* course. The *do* stage took place over two sessions per group, where one student acted as the Model Teacher (GM) while being observed by two peers serving as Observers (O). The *see* stage involved reflection sessions, where both the GM and the Observers presented their perspectives on the teaching practice and discussed the observation results.

The *Final Practicum Examination* included presenting edited videos of the microteaching sessions, followed by peer feedback from non-observer students. Additionally, students were required to submit LS reports and a learning analysis based on their observations and evaluations.

The learning tools developed by students applied both problem-based and project-based learning models. Each lesson plan was required to explicitly highlight *BTS* (Basic



Teaching Skills). The complete set of student learning tools can be accessed through the following link: *LS Learning Devices* (https://drive.google.com/file/d/15YiXHV1yV_RH4IQQtrHXwr6X898rKFgW/view?usp=sharing).

An example of a learning tool that integrates *BTS*, *4C* (Creativity, Critical Thinking, Collaboration, Communication), and *TPACK* (Technological Pedagogical and Content Knowledge) is presented in Figure 5.

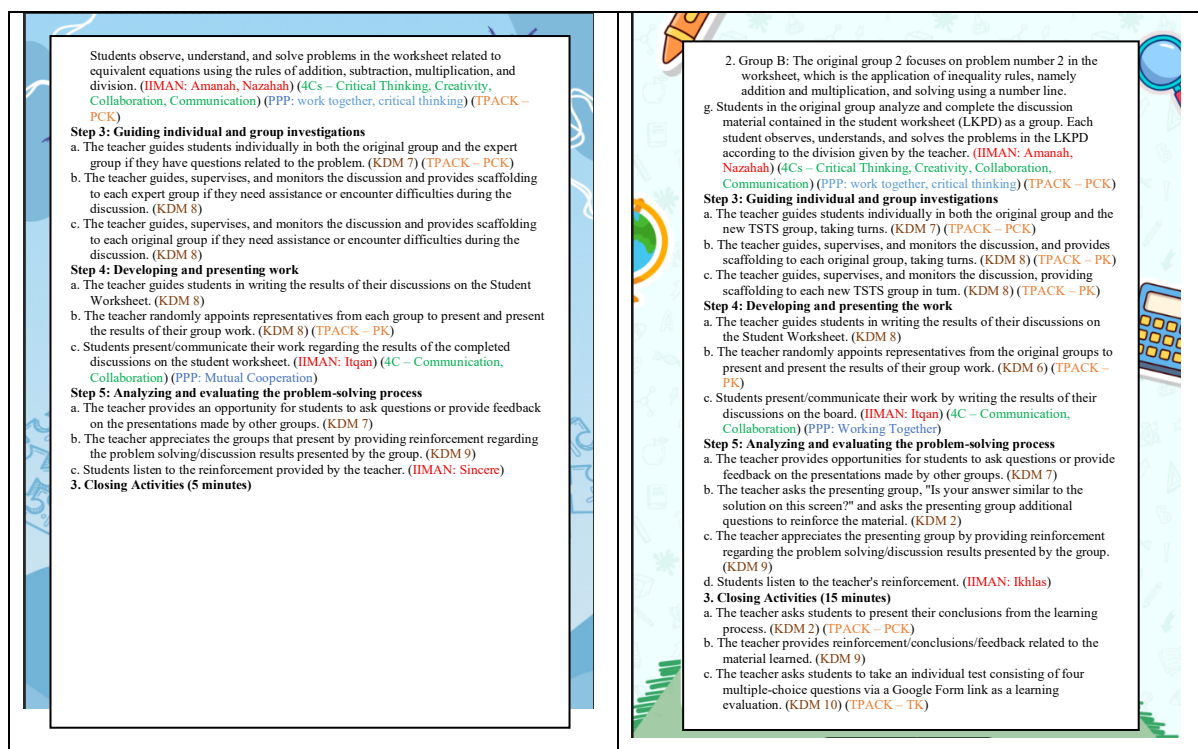


Figure 5. Example of a teaching module accompanied by TPACK, 4C, and BTS

Figure 5 illustrates the integration of the 4C components within the learning stages. The learning steps have also been aligned with the syntax of the selected learning model. Basic Teaching Skills (BTS) are comprehensively embedded throughout the learning process, from the initial to the final activities. The following discusses the embedded activities in the learning process.

Opening Lesson Skills

Opening lesson skills are implemented during the initial stage of the lesson. Theoretically, these skills are carried out using a question-and-answer approach. In practice, students demonstrate the ability to begin mathematics lessons by greeting the class, leading a prayer, conducting apperception activities, and providing motivation.

Variations in apperception activities conducted by students include:



- i) presenting a learning video and prompting students with questions related to the video content.
- ii) reviewing prerequisite material by posing questions and asking students to write their answers on the board.
- iii) displaying images and giving explanations related to the material being taught.

Variations in motivational activities include:

- i) showing videos that depict phenomena or real-world applications of the material being studied.
- ii) providing verbal explanations regarding the practical applications of the content being taught.

Examples of opening learning skills demonstrated by students are shown in [Figure 6](#):

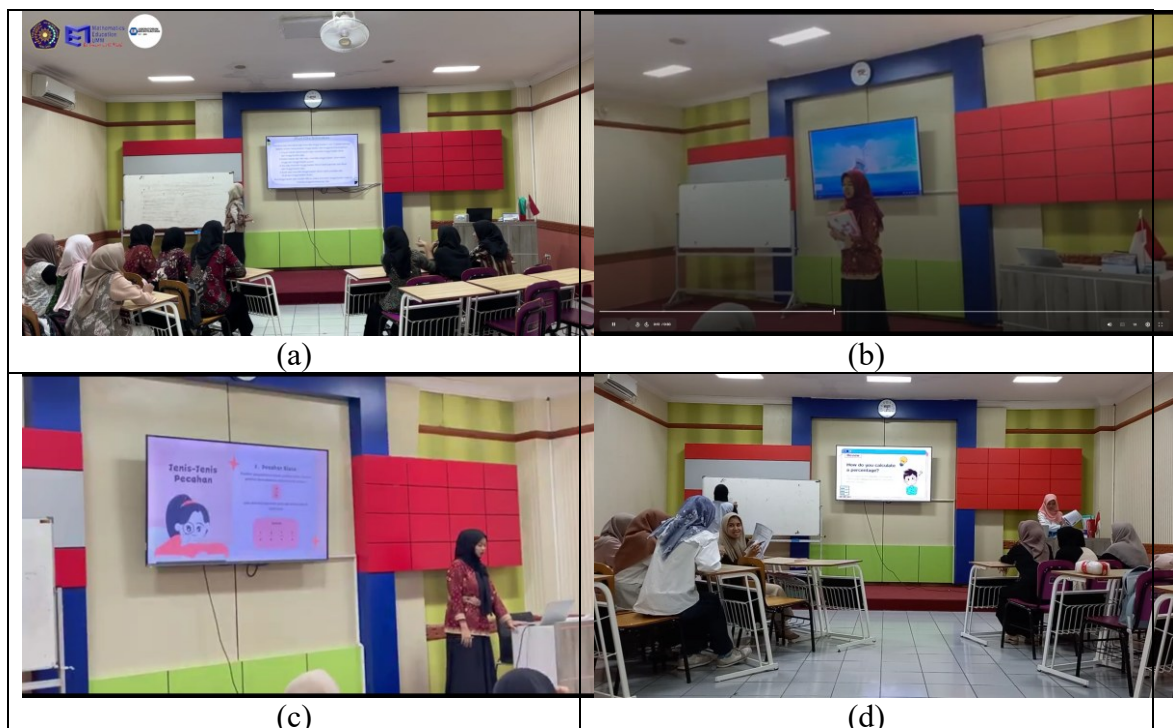


Figure 6. Documentation of Opening Learning Skills

[Figure 6a](#) shows an activity of displaying questions to open learning session and engage students in pair discussions. [Figure 6b](#) depicts an apperception activity where the teacher displays a video illustrating the application of integer operations in submarines. [Figure 6c](#) shows a motivational activity in which the teacher presents the lesson topic—algebraic operations—as prerequisite material for the subsequent topic on systems of linear equations in two variables. [Figure 6d](#) illustrates another motivational activity where the teacher poses trigger questions related to creating infographics.



Questioning Skills

Students' questioning skills are demonstrated through a sequence of questions ranging from those beginning with *whether* to those using *how* and *why*, which require more detailed and analytical responses. These questioning skills are most frequently observed during the initial activities in the form of trigger questions and during the final activities in the form of learning reflections.

An excerpt documenting examples of these questions is presented below:

Teacher : For today's topic on systems of linear equations in two variables, has anyone (M1) read the module provided in the previous session?

Students : Yes.

Teacher : Alhamdulillah. So, what (M2) do you know about systems of linear equations in two variables?

Students : There are two equations, ma'am.

Teacher : Why do you think (M3) there have to be two variables?

Students : Because if there is only one variable, we don't need more than one equation.

Teacher : If a linear equation with one variable can be solved using algebraic operations, then how about (M4) a system of linear equations in two variables?

Based on this interaction, the teacher's questions can be arranged in a hierarchy according to the use of question words. The hierarchy is shown in Figure 7.

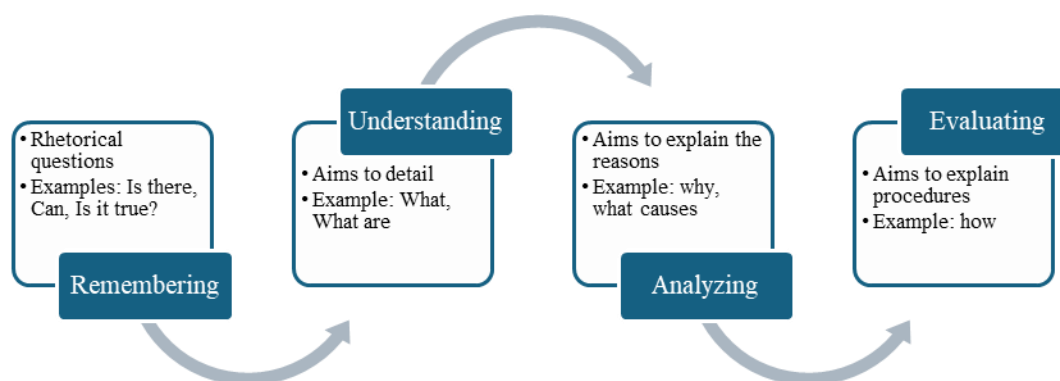


Figure 7. The hierarchy of questions words

Explanation Skills

Explanation skills in learning practice are primarily demonstrated during the core activities. Forms of explanation include: (i) problem explanation, (ii) identification of essential questions related to the project, and (iii) group division. Problem explanation is conducted in the first stage of Problem-Based Learning (PBL) or when the teacher monitors group discussions.

The explanation process often uses the brainstorming method, in which the teacher poses guiding questions to help students identify the meaning of the problem. Explanation



during group division aims to ensure group heterogeneity by differentiating members based on context and product outcomes.

Media Use Skills

Media use skills are categorized into two types: manipulative media and technology-integrated media. Examples of manipulative media developed by students include worksheets, scales, and posters. Meanwhile, technology-integrated media consists of PowerPoint presentations, instructional videos, and online quizzes.

Classroom Management Skills

Classroom management skills are observed based on how model teachers organize the learning environment to remain conducive and engaging. Student competencies in classroom management include:

- i) *Monitoring learning progress.* Model teachers conduct three rounds of teaching practice and analyze learning outcomes in terms of knowledge (tests), attitudes (observations), and skills (observations). These outcomes serve as the basis for group division in subsequent sessions.
- ii) *Addressing classroom disruptions.* For example, model teachers firmly reprimand students whose behavior disrupts the learning environment.

Use of Varied Teaching Strategies

During the microteaching sessions, the teacher demonstrated variation in several aspects of instruction, including classroom positioning, learning models, discussion formats, and the use of instructional media. The teacher's movements were dynamic—rather than remaining seated, the teacher walked around the classroom to assist student groups, monitored worksheet activities, and approached the display screen when explaining concepts or conducting quizzes.

The learning models employed by the model teachers include Problem-Based Learning (PBL), Project-Based Learning (PjBL), Discovery Learning, and Cooperative Learning (Jigsaw and Two Stay–Two Stray types). Discussion systems also vary, involving pair discussions, jigsaw structures, and game-based activities. The instructional media used include PowerPoint slides, videos, scales, posters, and worksheets.

Individual and Small Group Teaching Skills

Small group teaching skills are demonstrated when model teachers assist groups facing difficulties in problem-solving. The scaffolding technique is used to guide students'



understanding. The following is an example of teacher-student interaction found in the study.

Teacher : Which part do you find difficult?

Students : For the data on Worksheet A, what kind of diagram is appropriate to use?

Teacher : Let's reread the data. Is it single data?

Students : No, this diagram presents data on student violations over the last three years, which can be distinguished by year, gender, and grade level.

Teacher : Look again at the line diagram. What components should it include?

Students : The x-axis and y-axis.

Teacher : Good. If we use the x-axis for years and the y-axis for the number of violations, can we make a graph?

Students : Yes. What about the class categories?

Teacher : Try completing the graph for Grade VII first. How many lines do you need? One, right? Now, if we include data for Grade VIII, should we color the existing graph differently or create a new line?

From this interaction, it can be seen that the teacher provides limited but strategic explanations, encouraging students to actively find answers. The scaffolding approach promotes student engagement and supports independent reasoning.

Small Discussion Guidance Skills

Small discussion guidance is frequently implemented through scaffolding. The teacher identifies groups experiencing difficulty or failure in completing practical simulations, often intervening before students request help. Guidance is provided by prompting students to reread worksheet instructions and identify the main and supporting information in the given problems.

Reinforcement Skills

During Lesson Study (LS) 1, reinforcement was rarely implemented by most students. After group presentations, teachers typically ended the session by asking for a summary. However, in LS 2 and LS 3, reflections from the SEE phase indicated improvement. Model teachers began to provide reinforcement through explanations and feedback on group presentations, linking students' problem-solving processes to theoretical concepts. Students noted that reinforcement activities in PBL and PjBL served as a substitute for the brainstorming sessions typically conducted before group discussions.

Closing Learning Skills

Closing skills were demonstrated through two main activities: evaluating and reflecting on learning. Evaluation activities included:

- i) administering post-tests.
- ii) asking students to summarize the lesson.



iii) encouraging students to conclude the material verbally.

Reflection activities focused on eliciting students' feelings and insights about the lesson through questions such as, "what activities did you enjoy most during today's lesson?", "which activities did you dislike?", "what new knowledge did you gain today?", "what material do you still remember from this lesson?".

The BTS components that still require improvement are *explanation* and *reinforcement* skills. In providing explanations, model teachers should guide students to read the prepared teaching materials collectively. Consistent with previous studies, teachers can enhance explanations through scaffolding and feedback questions (Wragg & Brown, 2003; M. Zhang, 2022; S. Zhang, 2023).

In practice, some model teachers tend to deliver direct instructions rather than prompting student inquiry. During classical explanations, teachers often display limited variation in tone, fail to point to visual aids, and speak too softly. Verbal aspects such as intonation, volume, and coherence are essential indicators of effective explanation (Findeisen et al., 2021). Additionally, teacher gestures—such as pointing, sketching, or using hand movements—can improve conceptual clarity (Maton et al., 2021).

Reinforcement skills also need strengthening, as some students lack confidence in their mathematical understanding. Reinforcement should not merely involve rereading definitions but should provide feedback that connects student findings to core concepts. Effective reinforcement can involve emphasizing key definitions or theorems (Mandujano et al., 2025) and linking student-generated solutions to underlying theories (Kyriacou, 2007; Wragg, 2003).

The main findings of this study lie in the exploration of BTS for mathematics instruction through microteaching activities. This exploration highlights the implementation of lesson designs by model teachers and their observed teaching behaviours. Recommended follow-up actions include designing lessons that intentionally embed observable BTS; providing mentoring during microteaching sessions; conducting reflections on both prominent and underdeveloped BTS; and, documenting each microteaching session to analyse BTS performance during reflection.

CONCLUSION

The documentation study conducted before course reconstruction revealed that students' lesson plans lacked integration of BTS, differentiated instruction, and enrichment or remedial activities following assessment. FGDs with school mentors, field supervisors (DPL),



and *Introduction to School Field 2* students identified the need for mastery of teaching skills prior to classroom implementation. Curriculum reconstruction resulted in notable changes, particularly in course outputs, which now include both instructional materials and microteaching performance. Observations of microteaching sessions showed that BTS for mathematics instruction were demonstrated across all skill types.

The most prominent skills included *opening lesson skills* (providing motivation and activating prior knowledge), *media use skills* (using computer-assisted media such as PowerPoint with animations and conceptual simulations), *varied teaching strategies* (employing problem-based and project-based learning models), and *closing skills* (using game-based online quizzes for assessment). In contrast, less evident were skills related to *explanation and reinforcement skills*, primarily due to time constraints during microteaching sessions, which limited conceptual depth. Weaknesses in *reinforcement* stemmed from the absence of material summaries prepared by model teachers.

Future studies should further investigate microteaching course reconstruction outcomes that integrate BTS and gesture-based observation sheets. Moreover, subsequent research should analyse the impact of BTS mastery on student learning outcomes and engagement in mathematics classrooms.

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