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Developing Lesson Planning and Delivery Skills of Prospective Mathematics Teachers through the Microteaching Lesson Study Approach

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Abstract

In recent years, the Microteaching Lesson Study (MLS) approach has been intensively analyzed, especially in the context of working with students - future teachers - from both a theoretical and practical perspective. At the same time, peer feedback has become increasingly present in work with students, as it allows them to evaluate their fellow students' work and, after receiving comments, to reflect on their own teaching practice, which is also of great value for future teachers. This study examines the impact of MLS on the development of prospective mathematics teachers' lesson planning and delivery skills. A qualitative analysis of written lesson plans showed that students in the experimental group in which practical lessons were organized using the MLS approach had significantly fewer deficiencies in their written lesson plans than their peers in the control group who did not have the same opportunity. This improvement was obviously influenced by the strengths, weaknesses and suggestions for improvement that the students expressed to their classmates, first in peer feedback and later in the form of reflections after the delivered lesson. The results suggest that more space should be devoted to the MLS approach in the practical training of prospective mathematics teachers, as it enables them to develop teaching skills, foster a critical attitude towards teaching and develop habits of self-reflection.

Keywords: Microteaching Lesson Study, Peer feedback, Reflection, Prospective Mathematics Teachers

MSC2020: 97B50, 97D40, 97C70

1. Introduction

Content knowledge is particularly important for a good teacher. In view of the fact that it is becoming increasingly difficult to get new generations of students to acquire and discover new knowledge in mathematics lessons attentively, more and more attention is being paid to the pedagogical knowledge of teachers and their competence in methodically shaping the content of lessons according to the characteristics of the students they teach. The main goal of the Methodology of Teaching Mathematics course, a third-year undergraduate course at the Faculty of Science at the University of Kragujevac, is for students – prospective mathematics teachers – to master the planning and implementation of mathematics lessons as much as possible. In order to achieve this goal and better prepare them for their upcoming practical lessons in real school settings

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– which is also part of their bachelor studies – we introduced the idea of implementing the Microteaching Lesson Study (MLS) approach in the practical teaching component of this course.

The MLS approach has been widely studied theoretically and in terms of its practical impact in empirical research and has yielded positive results when working with prospective teachers. Therefore, we wanted to use the MLS approach to give students the opportunity to gain initial experience of planning and delivering mathematics lessons while enabling them to evaluate the quality of their peers' teaching critically. In addition, we wanted to encourage them to reflect on their own work in order to gain a deeper insight into the different aspects they need to consider and manage during the teaching process. With this in mind, this study presents a qualitative analysis of the effects of lesson delivery and peer feedback on prospective mathematics teachers' competencies in lesson planning and delivery.

2. Theoretical background

2.1. Microteaching Lesson Study as a method of professional teacher training

Microteaching is a system of controlled practice that makes it possible to focus on specific teaching behaviors and practice teaching under controlled conditions (Reddy, 2019; Bankira, 2021). In general, microteaching consists of a training cycle that involves fewer students, takes less time and consists of the following phases: planning, teaching, critiquing, replanning, re-teaching and re-critiquing (Bakır, 2014; Bankira, 2021). A prospective teacher, therefore, plans a short lesson, teaches it with a smaller group of students and then reflects on their teaching. The lesson can be video-recorded so that it can be assessed either individually or by colleagues. The prospective teacher's micro-lesson is reviewed, discussed, analyzed and evaluated to provide feedback. Based on this feedback, the prospective teacher teaches the micro-lesson again, considering the points raised in the discussion and analysis (Reddy, 2019).

Lesson study or "jugyokenkyu" in Japanese means "the study of teaching". The term "lesson study" was introduced by Makoto Yoshida, an expert in the field (Takahashi, Watanabe, & Yoshida, 2006). It refers to a professional development process in which teachers examine their practice together to become more effective. This involves a cycle of planning, teaching, observing, critiquing and revising selected lessons with clear overarching goals and research questions set in advance by the participating teachers (Zhou et al., 2016).

Microteaching Lesson Study (MLS) is a variation of lesson study that combines aspects of microteaching with key elements of lesson study into an experience designed to challenge prospective teachers' conceptions of teaching and learning while promoting the connection between theory and practice (Fernandez & Robinson, 2006). There are several versions of MLS in the literature. However, Fernández (2005) first conducted the original version with prospective high school mathematics teachers who worked in groups of three to plan, implement, analyze and revise lessons. It involves the individual planning and delivery of lessons with a small group of students, a subsequent peer reflection report and the submission of a revised lesson plan (Mukuka & Alex, 2024).

2.2. Lesson planning and delivery skills of prospective mathematics teachers through MLS

Microteaching has a significant impact on the teaching skills of prospective teachers (Bakır, 2014). This should also apply to MLS. In education, it is generally recognized that thorough and specific planning facilitates a valuable and productive teaching-learning process (Ferrer, 2021; Fitriati et al., 2023). Sporadic and haphazard planning, on the other hand, leads to unfocused and unproductive learning experiences (Dorovolomo et al., 2010). So, prospective teachers are taught how to plan their lessons during their training. Lesson plans help prospective teachers to bridge the gap between theory and practice (Sahin-Taskin, 2017), and MLS helps them to overcome problems in lesson preparation and improve their classroom management skills (Ekşi, 2012).

A good teacher must not only have subject matter knowledge, i.e. knowledge of their subject area, but also pedagogical content knowledge, i.e. knowledge of how to present and formulate the subject in order to make it understandable to others (Shulman, 1986). MLS provides a context for prospective teachers to develop pedagogical content knowledge, knowledge about teaching, content and learning and notions of reform-oriented teaching (Wahyu et al., 2016) by participating in classroom teaching as teachers, learners, and observers (Ekşi, 2012). Many researchers report that a range of teaching skills from the pedagogical content knowledge domain can be taught through microteaching, including: providing an introduction to the lesson, motivating students, classroom management, asking questions, considering students' needs, tone of voice, gestures and facial expressions, speaking correctly and fluently, selecting and implementing appropriate teaching methods and techniques, summarizing and conducting assessments (Benton-Kupper, 2001; Fernandez & Robinson, 2006; Fernández, 2010).

In general, there are many models in the literature of the knowledge required for teaching mathematics and suggestions as to how subject matter knowledge and pedagogical content knowledge can be divided. Koponen and colleagues state in their study that mathematical knowledge for teaching can be divided into six components, with three components representing subject matter knowledge and three components representing pedagogical content knowledge. The components that constitute pedagogical content knowledge are: knowledge of content and students, knowledge of content and teaching and knowledge of content and curriculum (Koponen et al., 2017). Knowledge of content and students refers to knowledge about how students learn mathematics, i.e. teachers' ability to anticipate students' difficulties and misconceptions, listen and respond to students' thinking, select appropriate examples for teaching and motivate and inspire students. On the other hand, Knowledge of content and teaching refers to teachers' choice of effective strategies, classroom arrangement, and decision making in planning their teaching. Knowledge of content and curriculum includes knowledge of the content of curricula and, in addition, knowledge of teaching materials (such as textbooks, other materials, etc.), teaching aids (blackboards, projectors, geometry set, etc.) and technology (computers, smartboards, calculators, software, etc.) (Ball et al., 2008).

2.3. Feedback and reflection of the lessons through MLS

Microteaching, peer assessment, self-assessment and critical thinking are interrelated concepts. They consist of prospective teachers preparing and presenting short lessons to a group of students and then reflecting on their teaching experiences (Ilhan et al., 2023). In addition to collaboration, reflection is very important for learning through MLS (Zhou & Xu, 2017). It is a good approach to teaching because prospective teachers can reflect on what is good or not good about their teaching or to what extent it corresponds to what was planned and what was taught in a lesson. Comments from other students provide students with useful suggestions that they may not have considered when creating the lesson plan (Zanaton et al., 2024).

MLS provides a more detailed discussion of mastery of appropriate skills and is designed to provide prospective teachers with feedback to improve their teaching behavior. It creates a simplified and controlled teaching environment that minimizes the usual complexity of the classroom and allows teachers to receive targeted feedback on their performance (Elias, 2018). The process of giving and receiving feedback on a lesson allows prospective teachers to look at their teaching skills from different angles. Constructive feedback plays an important role in microteaching, as students – who are familiar with the relevant theory – can evaluate the lecturer's skills and improve their own at the same time. By evaluating feedback from their peers, prospective teachers can identify which aspects of teaching were effective and gain insights into how they can improve their teaching in the future (Mergler & Tangen, 2010).

3. Research questions

This paper aims to examine the contribution of the Microteaching Lesson Study approach in the Methodology of Teaching Mathematics course, with a focus on feedback and lesson reflection, to the development of prospective mathematics teachers' lesson planning and delivery skills. In line with this aim, three research questions were defined.

RQ1. Does the MLS contribute to the development of prospective mathematics teachers' lesson planning and how?

RQ2. How do prospective mathematics teachers evaluate the lesson planning and delivery of their peers when they deliver lessons as part of the MLS?

RQ3. How do prospective mathematics teachers reflect on their own lesson planning and delivery skills when delivering lessons as part of the MLS?

4. Methodology

4.1. Procedures

The version of MLS used in this study is based on the work of Fernanadez (2005) with minor adaptations to the approach. The prospective teachers first plan lessons individually and present them to a small group of other prospective teachers. A written reflection report is then produced on site, and the prospective teachers' peers provide individual feedback. Based on these reports, the prospective teachers receive suggestions from their peers on how to improve the lesson and on changes they could make when planning and delivering the same lesson.

4.2. Instruments

In this study, three types of questionnaires designed according to the categorization of pedagogical content knowledge (Koponen et al., 2017) are used, but with some minor modifications. These changes were prompted by the characteristics of the curricula currently in effect in the Republic of Serbia, especially regarding outcome-oriented teaching and the documentation that prospective teachers must keep during their professional practice. This is *the content and teaching aspect* of the lesson, which refers to all indicators related to teaching methods and strategies, objectives and outcomes of teaching, inter- and intradisciplinary connections, as well as the forms of work and teaching aids used by the teacher to present the content of the lesson. Then there is *the content and students aspect*, which refers to the indicators concerning the general atmosphere in the classroom in which the lesson content is processed, i.e. the way the teacher presents the content, his or her interaction with the students as well as the students' mutual interaction, giving feedback, maintaining attention, encouraging students' logical engagement and thinking, and adapting the demands and pace of work to the students. Finally, we have *the content and curriculum aspect* of lesson, which refers to all indicators related to the structuring of the selected teaching content, its arrangement, the clarity and logic of presentation during the lesson, the use of technical language, the appropriate motivation and connection to the students' prior knowledge in the introductory part of the lesson and an appropriate review of the application of this teaching content in the final part of the lesson.

4.3. Data Collection

The study was conducted at the Faculty of Science, University of Kragujevac as part of the course Methodology of Mathematics Teaching Mathematics in the academic years 2021/2022, 2022/2023 and 2023/2024. One of the requirements for the students was to write lesson plans for teaching units covered in both primary and high school. For the purposes of this study, only the lesson plans intended for high school were observed and analyzed.

A total of 46 students took part in the study, who were divided into two groups: a control group – students who took the course in the 2021/2022 academic year (17 female and 3 male students) and an experimental group – students who took the course in the 2022/2023 and 2023/2024 academic years (21 female and 4 male students). Both the students in the control and experimental groups took the Methodology of Teaching Mathematics course in the sixth semester of their study, in which they had previously been exposed to methodology-related subjects, having only taken mathematics courses in the first five semesters. Students from both groups, both the experimental and the control group, attended the same type of lectures, while the exercises differed. The structure of the exercises was different, so the effects of MLS on the development of lesson planning and delivery skills could be investigated.

The control group attended weekly theoretical lectures and practical exercises throughout the semester. The lectures dealt with the theoretical foundations of lesson planning, including global and operational plans, learning objectives and outcomes, teaching methods and forms of work, teaching materials, educational standards, interdisciplinary and intradisciplinary connections. During the 12-week practical phases, students carried out various activities to prepare lesson content and plan teacher and student activities in line with the theoretical foundations.

The experimental group had the same lectures, but the exercises were carried out in two phases. The first eight weeks were devoted to intensive work on the planning and preparation of all segments of a lesson (objectives, outcomes, methods, forms, materials, content, and teacher-student activities) through various individual and group activities. The last four to five weeks (depending on the number of students) were dedicated to microteaching, i.e., the delivery of the lesson by each student in a simulated classroom with other students.

Each student (hereafter referred to as student-teacher) was assigned a specific lesson from the high school curriculum (for grades 1-4) and had seven days to create a lesson plan that was used during the delivery of the lesson but not submitted for grading. In the simulated high school classroom, other students assumed the role of learners (hereafter referred to as student-learners) and actively participated in the lesson. They also acted as observers and assessed various aspects of the lessons using prepared evaluation questionnaires. The evaluation questionnaires completed by student-learners after each observed lesson were divided into three types. Each student-learner received one of the questionnaire types and was asked to complete it by the end of the lesson.

The first type of questionnaire deals with the content and teaching aspect of the lesson, i.e. all indicators related to the teaching methods and strategies, the objectives and outcomes of the lesson, the inter- and intradisciplinary connections and the forms of work and teaching aids used by the teacher to present the lesson content.

The second type of the questionnaire deals with the content and student aspect of the lesson, which refers to the indicators concerning the general atmosphere in the classroom in which the lesson content is dealt with, i.e. the way the teacher presents the content, his/her interaction with the students as well as the students' mutual interaction, giving feedback, maintaining attention, encouraging students' logical engagement and thinking, and adapting the demands and pace of work to the students.

The third type of the questionnaire relates to the content and curricular aspect of the lesson, which refers to all indicators related to the structuring of the selected teaching content, its arrangement, the clarity and logic of presentation during the lesson, the use of technical language, the appropriate motivation and linking to students' prior knowledge in the introductory part of the lesson and the appropriate review of the application of this teaching content in the final part of the lesson.

Each part of the questionnaire contained 10 statements describing specific indicators. Student-learners rated the extent to which each indicator was present on a 4-point Likert scale. They also had the opportunity to make open comments, highlight positive aspects, criticize, and suggest ways to improve the observed lesson.

After conducting the lesson, the student-teachers had a further seven days to revise and submit the final version of the lesson plan based on their reflections and the student-learners' feedback. The assessment of the lesson therefore consisted of: (1) a written self-reflection by the student-teacher, which was included in the lesson plan, and (2) anonymous evaluation questionnaires completed by the student-learners and submitted to the student-teacher before the final version of the lesson plan was submitted.

4.4. Data Analysis

To answer the research questions, the collected data were analyzed as follows: (1) qualitative analysis of the lesson plans – a comparison between the control and experimental group, (2) thematic analysis of the feedback comments from the questionnaires completed by the student-learners, and (3) thematic analysis of the student teachers' reflections after the delivery of the lessons and the student-learners' feedback.

The collected student-teachers' lesson plans were subjected to a qualitative analysis that focused on the aspects of content and teaching, content and students, and content and curriculum aspects of lesson planning as described above. The analysis examined how the students structured their lesson plans – how they selected and organized lesson content, the extent to which they adhered to pedagogical guidelines, how they planned teacher and student activities during lessons, and how they integrated various elements of lesson planning. This included the precise formulation of lesson objectives and outcomes, the selection of appropriate teaching methods, forms and materials, and the inclusion of inter- and intra-disciplinary connections between the selected lesson content.

The student-teachers' reflections and the student-learners' comments were evaluated using thematic analysis. Thematic analysis is a method of identifying, analyzing, and representing patterns (themes) in data that allows researchers to organize and describe a data set in detail (Braun & Clarke, 2006). Through the application of thematic analysis and the use of MAXQDA 24 software for data analysis, dominant categories of comments were identified in the students' evaluations for all three aspects observed. Key categories were also identified in the student-teachers' reflections, highlighting the strengths and weaknesses they recognized after delivering the lesson.

5. Results

5.1. Analysis of lesson plans

First, we analyzed the deficiencies and inaccuracies in the written lesson plans of the students in both groups, analyzing the plans of the experimental group after the students made revisions based on the feedback they received and after reflecting on their submitted plans. Fig. 1 shows the percentage of lesson plans with identified flaws in relation to the total number of submitted plans, separately for students in the control and experimental groups.

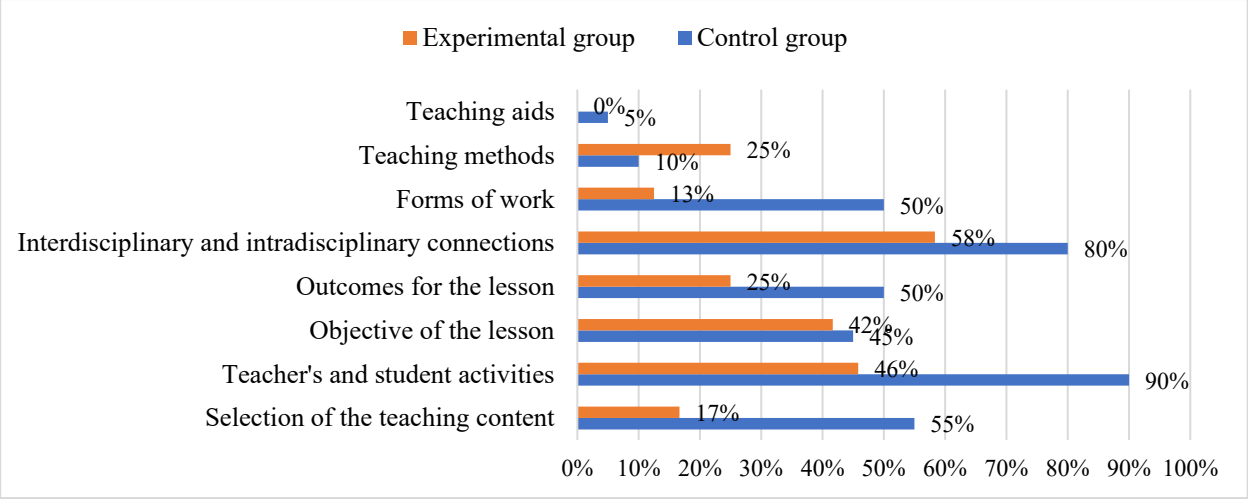

Fig. 1. Percentage of flaws in relation to the total number of lesson plans collected.

The clearest differences in the flaw rate were found in teacher and student activities, reflecting the content and student aspects of lesson planning. Specifically, 90% of the lesson plans submitted by the control group contained flaws in this area, while this percentage was significantly lower in the experimental group (46%). Another area in which notable discrepancies were found is the content and teaching aspect, particularly in the integration of inter- and intradisciplinary connections. Flaws in recognizing and planning such integration occurred in 80% of the plans in the control group, compared to 58% in the experimental group.

A significant difference was also found in the formulation of learning outcomes. Half of the lesson plans in the control group (50%) showed inaccuracies in the definition of learning outcomes, while this problem occurred in only 25% of the plans in the experimental group. Similarly, although to a lesser extent, differences were found in the definition of lesson objectives – an essential element of lesson plan. Flaws in this component were found in 45% of the lesson plans in the control group, compared to 42% in the experimental group.

In addition, the students who had the opportunity to deliver a lesson chose and structured the lesson content more effectively, reflecting content and curriculum aspect of lesson planning. While 55% of the lesson plans in the control group contained flaws in the selection of content, only 17% of the plans in the experimental group had such problems, indicating a significant difference in the content and curriculum aspect of the lesson. In contrast, there were only minor differences between the two groups in certain elements of the lesson plan, such as the selection of teaching aids. Flaws in this area were found in 5% of the lesson plans in the control group, while no such flaws occurred in the experimental group (0%).

5.2. Analysis of the student-learners' comments

The student-learners' comments were divided into three main categories according to the type of response: positive aspects, critical remarks and suggestions for improvement. Within each category, subcategories related to specific aspects of the lesson were identified. The main categories are: (1) positive aspects – elements of the lesson that were rated as particularly successful by the student observers, (2) critical remarks – comments highlighting shortcomings or problems in the delivery of the lesson, and (3) suggestions for improvement – recommendations made by the student-learners to improve specific aspects of the teaching process.

All subcategories of positive aspects made by student-learners about their peers' teaching and their share of the total number of positive comments are shown in Fig. 2.

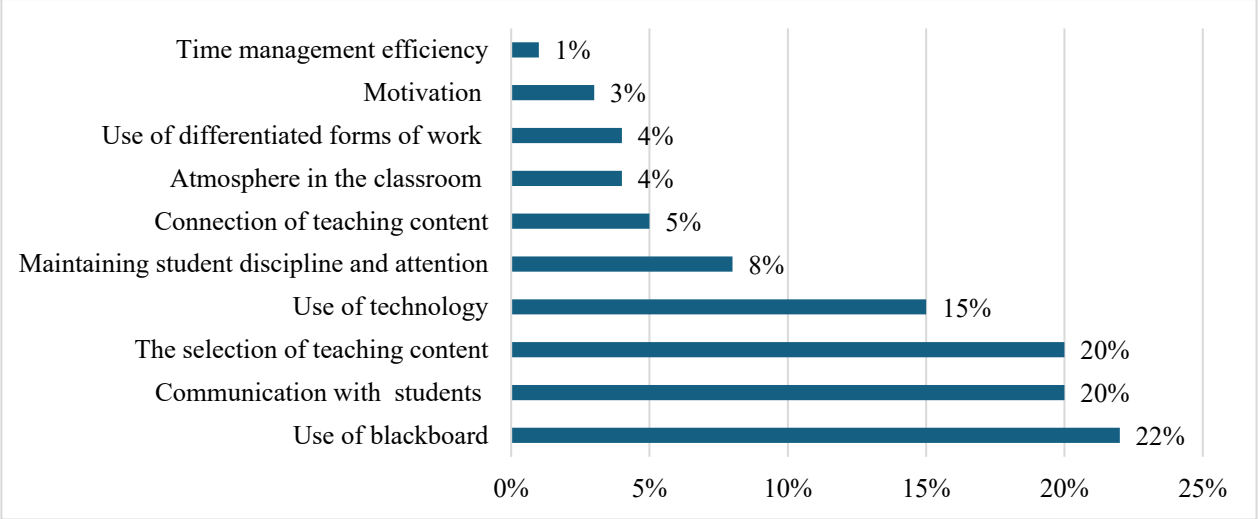

Fig. 2. Positive aspects of the lessons according to the student-learners

Among the most frequently mentioned strengths, student observers highlighted the high level of competence that student teachers demonstrate in using one of the basic teaching tools – the blackboard (22%) – as well as in interacting and communicating with students and giving meaningful feedback (20%). The selection of teaching content (20%) and its appropriate presentation using technology (15%) were also recognized as important positive aspects of the observed teaching. In contrast, the least frequently emphasized positive aspects included the efficiency of time management and the positive impact on increasing students' interest in actively participating in class.

Fig. 3 illustrates the categories of critical remarks in the student learners' comments and their proportion of the total number of critical observations recorded.

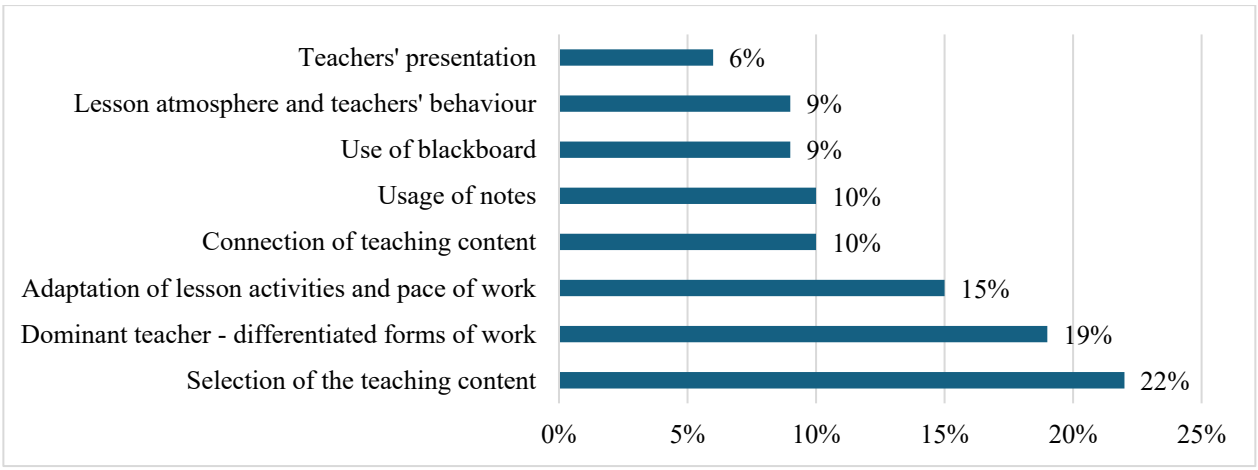

Fig. 3. Critical remarks of the lessons according to the student-learners

The main points of criticism concerned the need for a more appropriate selection of teaching content (22%), the reduction of the teacher-centred approach through more varied and differentiated forms of student work (19%) and the adaptation of teaching activities and pace to students' abilities and needs (15%).

Fig. 4 shows the categories of suggestions for improvement most frequently mentioned by the student-learners and their proportion of the total number of suggestions recorded.

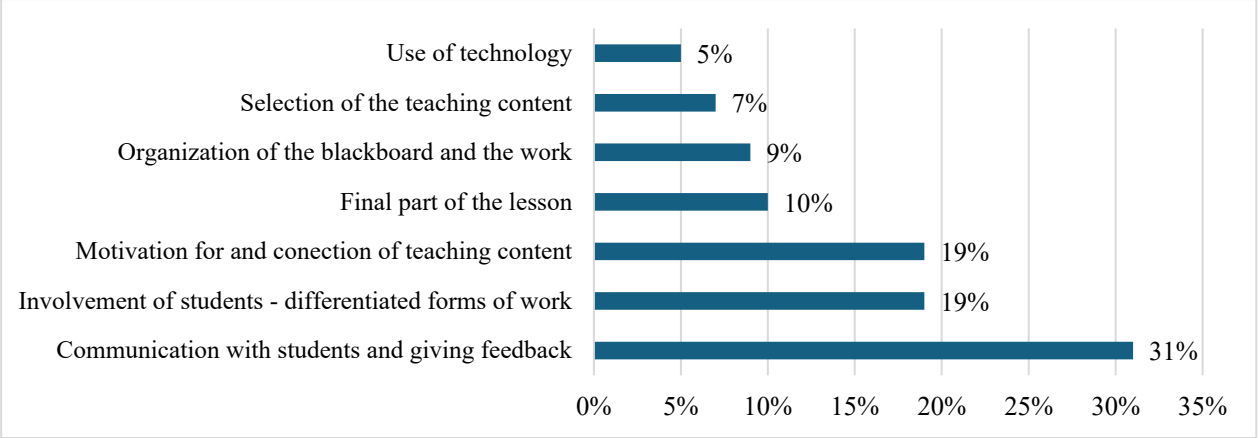

Fig. 4. Student-learners' suggestions for improving teaching

Student-learners emphasized the need to improve communication between teacher and students, to increase student engagement during lessons and to improve the provision of constructive feedback by teachers (31%). They also emphasized the importance of using more differentiated forms of work (19%) and better linking lesson content to motivating examples and real-life contexts (19%).

5.3. Analysis of the student-teachers' reflections

Based on the reflections of the student-teachers who conducted the lessons, several key categories can be identified that reflect their perceptions of their own teaching performance, challenges encountered and areas for improvement. The student-teachers' reflections were also categorized into three overarching categories, each of which includes subcategories related to specific aspects of the teaching process. These categories are: (1) positive aspects – elements of teaching that the student-teachers rated as particularly successful, (2) critical remarks – problems and challenges that the student-teachers identified during their teaching, and (3) suggestions for improvement – areas that the student-teachers identified as needing improvement in their future teaching.

Fig. 5 shows the categories of positive aspects most frequently mentioned by the student-teachers and their share of the total number of positive comments recorded.

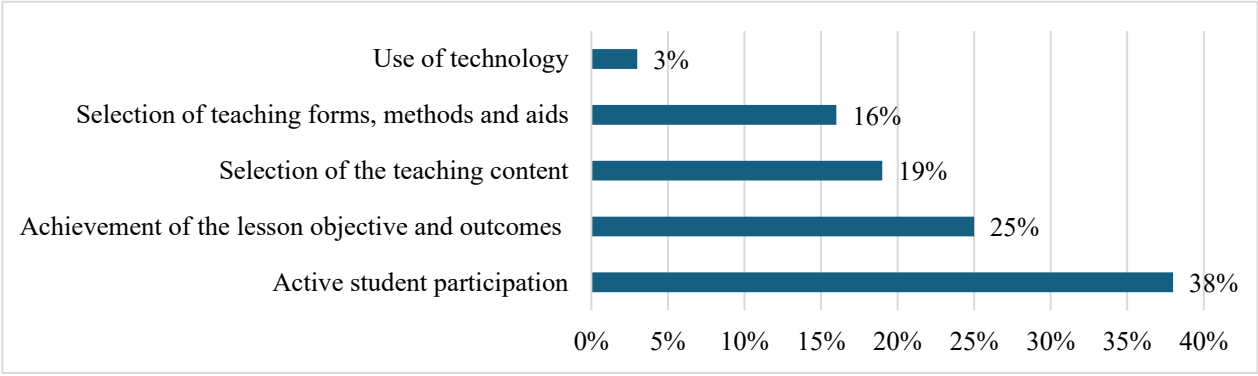

Fig. 5. Positive aspects of the lessons according to the student teachers

The most frequently emphasized positive aspect reported by student-teachers was the quality of interaction with students and their active engagement during lessons (38%). This was followed by statements indicating that the planned lesson objectives and learning outcomes were successfully achieved in the class, as evidenced by students' understanding of the material, active participation and successful completion of tasks (25%). In addition, 19% of comments referred to the appropriate selection of lesson content, such as well-chosen examples and tasks, while 16% highlighted the

effective use of teaching methods, formats and materials. In some cases, the use of educational software such as GeoGebra was mentioned as a helpful tool to illustrate better mathematical concepts, which was seen by some student teachers as a positive contribution to the quality of teaching (3%).

All categories of challenges mentioned by student teachers during their teaching practice and their proportion of the total number of comments coded as critical remarks are shown in Fig. 6.

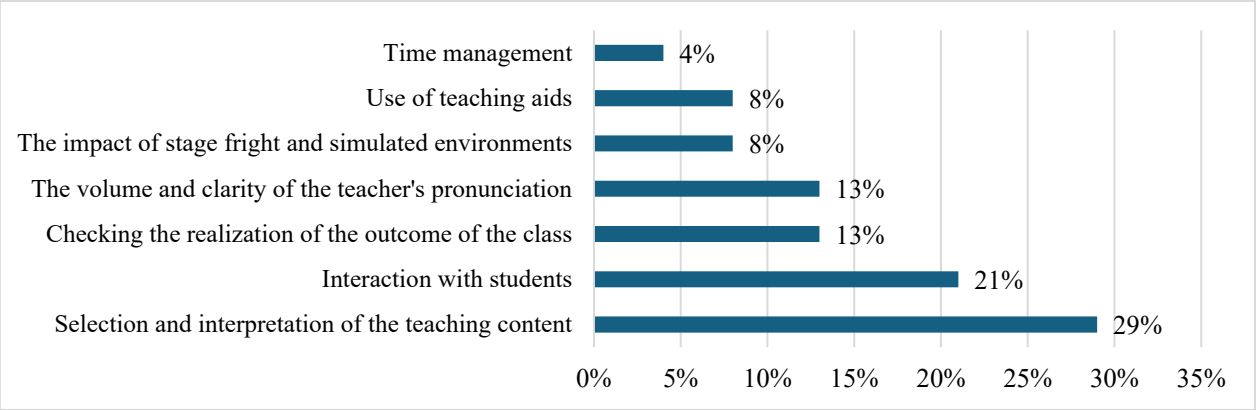

Fig. 6. Critical remarks on teaching by student-teachers

Several student-teachers (29%) indicated that they would choose a different lesson content or organize the lesson differently if they were to do the lesson again. A significant proportion (21%) mentioned problems related to the relationship between teacher and students, in particular lack of student motivation and insufficient interaction between teacher and students. In addition, 13% of student teachers acknowledged that they had failed to check at the end of the lesson whether the learning outcomes had been met, or to review key concepts and summarize the main points – activities that would have helped students to build a better structure and retain the newly acquired knowledge. A further 13% pointed out that they could have been clearer, i.e. louder and slower, to improve students' understanding during explanations.

Interestingly, two comments pointed to the effects of performance anxiety and the artificial nature of the simulated classroom environment. These student-teachers indicated that teaching in front of peers who took on the role of students felt unnatural and affected their ability to deliver lessons as intended. A smaller number of critical reflections related to the limited use of the blackboard and insufficient organization of written content (8%), insufficient adjustment of the pace of the teaching to the students' needs (4%) and poor time management, e.g. the need to reduce the theoretical part of the lesson or the number of tasks to achieve a more balanced structure.

The suggestions for improvement made by the student-teachers following the implementation of their lessons are shown in Fig. 7.

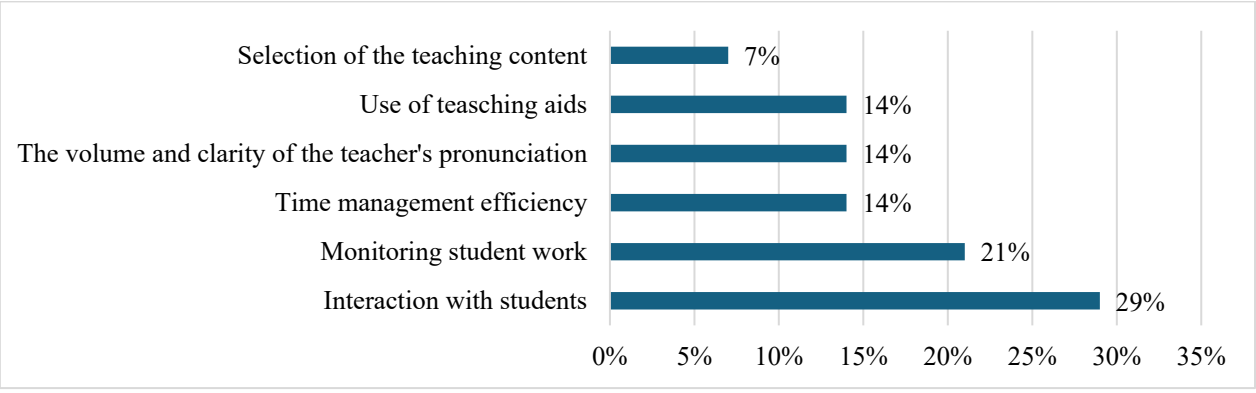

Fig. 7. Suggestions for improvement from the student-teachers

The most frequently mentioned suggestions (29%) relate to the need to improve student-teacher interaction, particularly by asking more questions and encouraging student discussion and reflection rather than relying solely on teacher explanations. In addition, 21% of comments emphasized the importance of moving around the classroom and observing students' work more actively.

Several student teachers also mentioned time management as needing improvement (14%), pointing to the need for more effective time management during the different phases of teaching. An equal percentage (14%) emphasized the importance of paying attention to tone of voice, volume and clarity of language to ensure better student comprehension. A further 14% recommended the use of prepared lesson materials for students, including key definitions and theorems, to reduce the amount of time spent writing on the board and to allow more time for interactive engagement with students. A smaller proportion of comments (7%) related to the selection of lesson content, suggesting that a more careful selection of examples and tasks could further improve the overall quality of teaching.

6. Discussion

The results of this study provide valuable insights into the lesson planning and delivery skills of prospective mathematics teachers, as developed within the MLS approach in the Mathematics Teaching Methodology course.

Through qualitative analysis of the lesson plans, notable differences were found between the students who had the opportunity to teach a lesson and receive direct feedback (experimental group) and those who relied only on theoretical activities (control group). It was found that certain aspects of teaching skills developed better through the process of reflection and evaluation after the lesson.

The results suggest that students who conducted a lesson as part of MLS committed fewer flaws in planning and preparation than those who did not. One of the most significant differences between the groups concerned the organization of teacher and student activities. The experimental group showed better structuring of the lesson activities, which was confirmed by the feedback from the participants who emphasized a clearer lesson structure, and a more dynamic lesson flow compared to the control group. In contrast, students in the control group often showed uncertainty and lack of depth in the planning of teacher and student activities, which was reflected in the imprecision and vagueness of their written plans. A clear difference was also found in inter- and intra-disciplinary connections. The control group often neglected or insufficiently defined this aspect, while the experimental group made more coherent connections between the content and other disciplines. A clear difference was also found in the formulation of lesson objectives and outcomes: Students who had completed a lesson were more likely to be able to clearly define the objective and state achievable learning outcomes, in contrast to their peers in the control group. In addition, students in the experimental group were more successful in selecting, coordinating and sequencing lesson content. In line with all the above, we can confirm that the MLS approach contributes to the development of prospective mathematics teachers' skills in lesson planning, thus providing a positive answer to the first research question.

Post-lesson peer feedback played a crucial role in improving the quality of lesson plans by allowing students to identify and address specific problems in planning and delivery. In general, the control group made more frequent and more serious flaws in lesson preparation, which was also reflected in the observations and criticisms of the other participants. Conversely, the experimental group showed progress precisely in the areas for which they had received feedback and in which they were able to improve. Flaws in the planning of teacher and student activities occurred significantly more frequently in the control group. Peer comments most frequently pointed to the dominant role of the teacher, lack of student engagement and difficulties in maintaining attention and active participation. Flaws in setting lesson objectives and outcomes and in selecting and connecting lesson content also occurred more frequently in the control group. Their lessons were often described as poorly led, with unclear or disjointed sections and a pace that did not meet the needs of the students. In addition, a lack of connection between new content and prior knowledge

or real-life examples was frequently noted. Feedback from participants reflects these issues and highlights the need for more varied teaching formats and student involvement in the learning process. An answer to the second research question can also be derived from this: Despite a lack of prior experience in evaluating their peers' lessons, students paid attention to various aspects of lesson planning and delivery and contributed to improving their peers' teaching skills through their feedback.

Students' reflections showed that they became more aware of their own strengths and weaknesses – particularly in the organization of lessons, explanation of content, interaction with students and effective time management. The weaknesses observed in the lesson plans of the control group matched the self-assessments of the members of the experimental group, further confirming the reflection process as an important development tool. The qualitative analysis of the reflections suggests that the practice contributed to a deeper self-awareness of the student teachers, especially in terms of time management, pacing and the use of technology to visualize content. In the control group, flaws in content selection occurred more frequently, while students in the experimental group often thought about ways to better structure lessons, reduce theoretical content and focus on practical tasks. Flaws in the integration of content occurred in both groups but were less pronounced in those who had carried out the lessons.

Interestingly, even the students in the experimental group admitted in their reflections that they could have illustrated connections better and used more real-life examples, suggesting that contextualizing content remains a challenge – even after the lesson has been delivered. In terms of the pedagogical and psychological aspects of teaching, students in the experimental group emphasized the need to move around the classroom more, monitor students' work and improve communication with learners. We can conclude that prospective mathematics teachers are able to objectively reflect on their own teaching skills when conducting lessons within the MLS according to their level of experience, which is also an answer to the third research question.

Our findings are largely consistent with previous studies. For example, in a previous study, Kazu (1996) indicated that prospective teachers who had completed a microteaching exercise subsequently had less difficulty in writing lesson plans, planning and conducting the introductory part of the lesson more effectively, using a more appropriate tone of voice, speaking more correctly and accurately during the lesson, paying more attention to their gestures and facial expressions, and presenting the content more appropriately and effectively during the main part of the lesson. They also performed the last part of the lesson more successfully than their peers who did not participate in microteaching (Kazu, 1996). In other studies (Fernandez, 2010; Fernandez & Robinson, 2006; Mergler & Tangen, 2010; Taşdelen Kaçkay & Sanlı, 2009), authors have also shown that the MLS approach helps to raise students' awareness of the need for differentiation in the classroom, the selection and implementation of appropriate teaching methods and techniques, and many other aspects of teaching that were also observed in our study. According to the methodological approach adopted in this study, students benefited from the provision of peer feedback, which other authors have also highlighted as an extremely valuable approach (Milenković & Matejić, 2023; Zanaton et al., 2024), as well as from reflecting on their own work (Zhou & Xu, 2017).

7. Conclusion

This study helps to confirm the development of prospective mathematics teachers' teaching skills through the MLS method, and in particular highlights the importance of reflection and peer feedback in improving the quality of both lesson planning and delivery skills. In addition, the study underscores the value of peer feedback – an often overlooked component in teacher education – and provides an authentic context by providing applicable insights for improving prospective teacher education programs. The results of the study suggest that students in the Microteaching Lesson Study approach improve their skills in planning and delivering a particular lesson based on feedback from their peers who are prospective mathematics teachers, as well as through self-reflection and by revising the initial version of their lesson plan.

However, the study has certain limitations, including the relatively small sample size and the associated subjectivity of peers' feedback, but it can serve as a basis for broader future research.

Ultimately, we can conclude that instruction and peer feedback through MLS significantly impact the development of prospective mathematics teachers' pedagogical content knowledge and that this approach should be given more attention in the education of prospective mathematics teachers.

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