



Microteaching for mathematics teachers in higher education: a review of recent development

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Abstract: Microteaching, a practice oriented teaching technique, where teachers practice specific skills in short, micro-lessons, is a professional development tool for mathematics in higher education, particularly for pre service teachers. This paper surveys, recent research on microteaching for mathematics teachers in higher education published between 2021 and July 2025, following an earlier literature review for teachers in higher education across different disciplines. A thorough analysis of 26 articles published in peer-reviewed journals focusing on microteaching for mathematics teachers in higher education. The findings suggest that microteaching allows for the development of core teaching skills in a controlled environment with immediate feedback, promoting effective professional development in higher education.

Key words: Microteaching; Mathematics teachers; Higher education.

1 Introduction

In recent years, use of microteaching for mathematics teachers in higher education has grown due to evolving pedagogical needs and the integration of digital tools. Microteaching for mathematics teachers in higher education is a teacher training technique developed in the year 1960, involves teaching shorts, micro-lessons to the small group of students of higher education for 5-10 minutes. As a way to breakdown the complex teaching skills systems, microteaching was first introduced at Stanford University by Professor Dwight W. Allen in 1963.

Microteaching workshops provide an opportunity to mathematics teachers in higher education for practice their teaching techniques and receive feedback in a controlled and non-threatening setting. The focus of feedback is on teaching clarity, student engagement, and teaching techniques. Generally, in North America microteaching is used for new teaching as-

sistants and for relatively new teachers at the College or University level. This is often done in conjunction with a coaching session, where a new instructor meets an educational consultant or coach to discuss their teaching procedures and skills. While microteaching is distinct from a pedagogical coaching program, the issues and contents often overlap. College or University teachers also tend to schedule their microteaching workshops and coaching sessions at similar times in one semester, so similar issues tend to arise in both sessions, or aspects of the microteaching presentation may also be brought up in a coaching session.

2 Purpose of microteaching for mathematics teachers in higher education

Due to the abstract nature of mathematics, it needs specific strategies for effective instruction. Microteaching in higher

education allows mathematics teachers to experiment with problem solving methods, mathematical modeling and interactive teaching techniques such as enquiry based learning. Microteaching is one of the process through which core teaching skills are developed among prospective mathematics teachers in most teacher training institutions (Alex & Thomson, [1]). Microteaching helps mathematics teachers in higher education refine specific teaching skills, such as lesson planning, delivery, questioning techniques and student engagement, in a condensed, focused manner.

3 Theoretical framework

Microteaching allows mathematics teachers in higher education to focus on specific teaching skills, like explaining concepts, asking effective questions before applying them in a full fledged classroom setting. Microteaching provides a safe space for mathematics teachers in higher education to experiment with new teaching methods and strategies without the pressure of a full class environment. It can be used to record lessons for later analysis, allowing mathematics teachers in higher education to review their performance and identify areas where they need to focus their efforts. Microteaching emphasizes the importance of feedback and reflection. Trainees receive constructive feedback from supervisors on their performance, allowing them to identify areas for improvement. The ultimate goal of microteaching for mathematics teachers in higher education is to facilitate the transfer of learned skills to real world classroom settings. By managing specific teaching skills in a controlled environment, trainees are better prepared to apply those skills in the complex and dynamic environment of a classroom. Perlberg's [2] contribution likely focused on the development and application of microteaching as a technique for teacher training. His research, along with

others like Morrison and Cameron Jones [3], delved into the impact of microteaching, student teaching and mini courses on student teachers.

4 Evolution of microteaching for mathematics teachers in higher education

Microteaching, a practice teaching technique involving scaled down lessons, has evolved significantly for mathematics teachers in higher education. It focused on small, controlled teaching experiences where pre-service teachers practiced specific teaching skills. The use of technology, such as video recording and online platforms, has become increasingly common in microteaching. This allows for more in depth analysis of teaching performance and facilitates feedback from peers and advisors. While microteaching often begins in a laboratory setting, its evolution includes opportunities for pre service mathematics teachers in higher education to practice in real classroom contexts, bridging the gap between theoretical knowledge and practical application. According to Cooper and Stroud [4], as cited by Allen [5], microteaching was initially established to serve three purposes: as a preliminary experience, as a research vehicle and as an in-service teachers development tool.

5 Implementation of microteaching for mathematics teachers in higher education

To implement the microteaching for mathematics teachers in higher education various models have been developed over time. Common models are the traditional model, which focuses on professional development through focused lessons to peers; the component model, which breaks down teaching into specific components for targeted skill development; the interactive model,

emphasizing active participation and collaboration and the other models are modeling method, the lab method, the clinic method, the lecture method etc. Larey et al. [6] emphasize that microteaching provides aspiring educators with opportunities to practice and reflect on their teaching skills. This process is crucial for developing and refining microteaching techniques for mathematics teachers in higher education in a low-pressure environment. The core of microteaching involves focused practice on specific teaching skills, such as presentation or reinforcement, with feedback and reflection on the recorded lesson (Lovemore [7]).

Stanford Microteaching Model

This model, developed by Cooper and Allen [8], focuses on a structured cycle of teaching, observation, and feedback, emphasizing controlled practice and skill development. James M. Cooper and Dwight W. Allen, begins with a definition of microteaching as a teaching situation which is scaled down in terms of time and numbers of students, but which is not synonymous with simulated teaching, as the teacher, students, and lesson are all "real." The history of microteaching from its development in 1963 is outlined, followed by an explanation of the rationale, the uses of microteaching in pre-service and in-service training in the Peace Corps, counseling, supervisor training, and the training of college teachers. Research evidence on the effectiveness of microteaching is examined and the teaching skills involved are listed (Said et al. [9]).

Stirling Model

The Stirling model emphasizes a cyclical process involving planning, teaching, and reflection, with a focus on continuous improvement within a dynamic environment.

Indian Model

This model, developed by NCERT, outlines specific settings for microteaching, such as a small class size (5-10 students) and a short duration (5-10 minutes). It also emphasizes a 36-minute microteaching cycle with peer and teacher educator feedback.

Skill-Based Model

This model focus on mastery of specific teaching skills i.e. questioning, reinforcement, explaining, blackboard use etc. Skill-Based Model is used in teacher training institutes to improve discrete teaching skills.

Computer-Assisted Microteaching Model

This model focus on technology in teaching practice that means this model uses video recordings of micro-lessons, AI or software based feedback, online simulations or virtual students (Mohammed et al. [10]). Benefits of this model are flexibility, self-paced improvement, scalable training etc.

The Modified Microteaching Model

This model is an adaptation of the traditional microteaching model, designed to enhance teacher training by focusing on specific teaching skills in a scaled-down, simulated environment. It involves a cycle of planning, teaching, observing, and providing feedback, with the goal of improving teaching effectiveness through iterative practice and reflection. The Modified microteaching model was implemented by John et al. [11]. In this model, three departments at the United States Air Force Academy successfully used a microteaching model to train new faculty. Like other models, its structured approach used videotaping and peer coaching. The model also contained several unique features, including a cross-

disciplinary approach to supplement feedback from department members and focused small group feedback with built-in preparation time. Thus, this model results not only in enhanced teaching performance, but also in departmental and institutional collegiality (Almeida and Weber [12]).

6 Method

My review approach adopts Page et al.'s [13] methodology, adapted to focus on microteaching for mathematics teachers in higher education. Here I discuss literature search and data analysis approaches used.

Literature Search

In July 2025, I conducted a systematic search on 'microteaching for mathematics teachers in higher education'. Five major online databases like Google Scholar, PsycINFO, Science Direct, Scopus and Web of Science were search terms 'microteaching' and 'mathematics' and 'teacher'. Here I selected articles that have been published on microteaching in mathematics teacher education between the year 2021 and July 2025. The 150 articles were downloaded from the above mentioned databases. Consistent with the recommended procedures for conducting systematic reviews (Hallinger, [14]; Page et al.[13]), I undertook the steps depicted in Table-1 to obtain a total of 26 reviewed empirical studies.

Data Analysis Approaches Used

Three analysis approaches were employed during data gathering and analysis: document analysis (Kitchenham, [15]), content analysis (Krippendorff, [16]), and thematic analysis (Braun & Clarke, [17], [18]). The goal of the document analysis technique was to identify relevant publications in relation to microteaching research in mathematics teachers in higher education. This approach was crucial in filtering 26 articles

from the 150 articles that were acquired from the two databases (Table 1).

After locating appropriate data, each article was reviewed, annotated, and arranged in line with the key themes and issues that were crucial for addressing the specified research questions. Braun and Clarke [17] recommended thematic analysis method was used at this point. This included getting acquainted with the data, doing some preliminary coding, finding and reviewing themes, and matching themes to the stated research questions. Through content and thematic analysis, the meanings and linkages of important components were established.

Table 1: Article selection process

Database Searched (n=150) → Excluded due to duplication (n=10) and Excluded due to indexing issues (n=25) → Articles eligible for second level screening (n=115) → Excluded because they were not relevant (n= 24) and Excluded because they did not focus on mathematics education(n= 65) → Articles eligible for review (n=26).

7 Results

What is the trend of scientific publications on microteaching methodology for mathematics teachers in higher education from 2021 to July2025?

In our study, 26 scientific publications from 2021 to July 2025 on the microteaching methodology for mathematics teachers in higher education were analyzed. The number of articles on this topic has increased every year, but the trend toward studying this topic has remained, which shows its relevance. Although the peak of popularity occurred in 2021, there are currently few articles that qualitatively reflect the degree of research on the problem. In my opinion, the quantity of the articles on the topic of microteaching for mathematics teachers in higher education is increasing as these days teaching process

requires constant improvement of methods and strategies to teach.

What countries are the research articles on the microteaching performances for mathematics teachers in higher education published in?

Based on the prescribed article inclusion/exclusion criteria, empirical research from 13 countries were reviewed. Out of the 26 studies examined, 11 were conducted in Turkey, five were from the USA, and two were from Greece. The findings also revealed that each of the other eight countries—Australia, Canada, China, Indonesia, Kenya, South Korea, Taiwan, and Tanzania—had only one paper reviewed from there.

The findings also show that the bulk of the examined research were carried out in Turkey, then the USA. Our analysis reveals that only seven (25.0%) of the examined papers were published between 2000 and 2013, and that 21 (75.0%) of the works reviewed were published during the last 10 years. This highlights the growth of microteaching research in the field of mathematics teachers education. A new book edited by Okeke et al. [19], “Managing the microteaching process”. Regarding the methodological approaches used, the findings indicate that 22 (78.6%) of the studies under examination used qualitative methods for data gathering and analysis. Only four (14.3%) of the research applied quantitative techniques, and two (7.1%) blended qualitative and quantitative methods. One potential explanation for this is that the majority of microteaching sessions employ video recordings, whose analysis is particularly successful when qualitative methodologies are applied. Additionally, qualitative analysis of video annotations helps and extend both self-reflection and peer assessment (Walshe & Driver, [20]).

Impact of microteaching for mathematics teachers in higher education

The study of review papers in other subjects (Remesh, [21]; Reddy, [22]; Phan, [23]; Chen [24]; Menon et al. [25]; Makatita et al. [26]; Sadikin et al. [27]) found that use of microteaching in the preparation of mathematics teachers in higher education is associated with a number of advantages.

From this review it is said that microteaching is an effective strategy for building up technological pedagogical content knowledge (TPACK) skills among mathematics trainee teachers in higher education (Kafyulilo et al. [28]; Acikgul, [29]; Nuraina and Rohantizani, [30]; Kittivarakul and Lertamornpong, [31]; Wulandari and Rezeki, [32]; Suripah et al. [33]). TPACK is a framework that describes the knowledge and skills teachers need to effectively integrate technology into their teaching practice, encompassing technological knowledge, pedagogical knowledge and content knowledge according to educational sources (Njiku, [34]; İlhan et al. [35]; Murtafiah & Lukitasari, [36]; Nurrahmah et al. [37]; Mentari and Pratama, [38]; Iliasova et al. [39]; Ryan and Ryan, [40]). Both technology and microteaching can be effective tools for helping pre-service teachers strengthen their fundamental mathematical teaching abilities. Microteaching, a technique used in teacher training, can be enhanced and made more effective through the integration of technology. Technology can facilitate the recording, analysis, and feedback processes in microteaching, leading to improved teaching skills. Other studies also show that pre-service teachers who participated in microteaching activities were more likely to be job-ready, particularly in three crucial areas such as, lesson preparation, lesson implementation, and lesson evaluation (Altammar & Aljassar, [41]; Unver et al., [42]; Halilu et al. [43]; Wang and Wang, [44]).

Microteaching Lesson Study (MLS) is a pedagogical approach that combines ele-

ments of traditional microteaching with the collaborative and reflective practices of lesson study. This approach aims to enhance prospective teachers' skills and understanding of teaching through a cycle of planning, teaching, observing, and revising lessons collaboratively (Mueller et al., [45]; Mukuta et al., [46], [47]; Ogegbo et al. [48]; Hernandez, [49]; Dikgwatle, [50]).

The study by Lin, [51], pre-service teachers who participated in journal writing, and watched and discussed video instances that had been enhanced by the developers displayed deeper reflections. The research by Yilmaz and Yetkin-Özdemir, [52], focuses on pre-service mathematics teachers' learning to notice student statistical thinking within a lesson study context. The study specifically examines how these teachers develop their ability to recognize and respond to students' statistical thinking throughout the lesson study process.

Challenges of Implementation of microteaching for mathematics teachers in higher education

Microteaching for mathematics teachers in higher education faces several challenges, including resistance from educators, time constraints, and difficulties in creating realistic scenarios. Additionally, some institutions struggle with funding and the integration of microteaching into existing curricula. Furthermore, concerns about the effectiveness of microteaching and the need for adequate resources can hinder its successful implementation. For instance, a study done in Turkey by Sen [53], found that it was difficult to use microteaching to its fullest potential due to the artificial nature of the learning environment and the lack of cameras to record the sessions.

Insufficient time allocated, and a lack of supervisors were also mentioned as barriers to effective implementation of microteaching (Basturk & Tastepe, [54]; Koech & Mwei, [55]; Paramitha et al. [56]; Polat, [57]). For example, Reddy, [22] pointed out that the time constraints associated

with microteaching may raise administrative issues while planning, which may lead to delays in the process.

Even though use of technology and microteaching have helped pre-service mathematics teachers in higher education to improve their fundamental teaching skills, doing so might be difficult due to time management issues and technical issues. The adoption of technology-based microteaching is fraught with obstacles, according to certain studies (Yenmez et al., [58]; Lee, [59]; Setyawati & Indiati, [60]; Zalavra & Makri, [61], Siu-Yung-Jong, [62], Kholid et al., [63]). These difficulties include handling technology correctly, reduced involvement, time constraints, and a lack of resources.

8 Limitations and perspectives

Microteaching offers valuable opportunities for mathematics teachers in higher education to hone their skills, but it also has limitations. While it allows for focused practice and feedback, it can be perceived as artificial and may not fully prepare teachers for the complexities of real-world classrooms.

Limitations

Artificial Environment: The microteaching setting, with a small group of peers and a limited timeframe, can feel artificial and not reflective of a typical classroom.

Limited Scope: Microteaching focuses on specific skills, which may not fully prepare mathematics teachers in higher education for the broad range of challenges and complexities encountered in real classroom settings.

Potential for Anxiety: Pre-service mathematics teachers in higher education may experience anxiety in the microteaching environment, which could hinder their ability to learn effectively.

Time Constraints: The time-limited nature of microteaching can make it difficult to adequately address all aspects of a lesson or to simulate the pace of a real classroom.

Feedback Challenges: While feedback is crucial, providing constructive feedback in a peer-to-peer setting can sometimes be difficult, and students may not always trust their peers' assessments.

Resource Intensive: Microteaching can require significant resources, including time for supervisors, equipment for recording and playback, and potentially specialized facilities.

Perspectives

Skill Development: Microteaching allows mathematics teachers in higher education to focus on specific skills, like lesson planning, presentation, and classroom management, and receive targeted feedback to improve those skills.

Increased Confidence: Practicing in a controlled environment can help teachers build confidence in their teaching abilities before facing a full classroom.

Opportunities for Reflection: Microteaching provides a structured opportunity for teachers to reflect on their teaching practices and identify areas for improvement. **Adaptability:** While not a perfect simulation, microteaching can be adapted to focus on specific skills or concepts relevant to mathematics teaching in higher education, such as explaining complex mathematical ideas or using manipulatives.

Integration with Technology: Technology, like video recording and analysis tools, can enhance the microteaching experience by providing more detailed feedback and allowing for self-reflection.

In the context of mathematics education, microteaching can be particularly useful for:

Developing pedagogical content knowledge: Helping teachers understand how to present mathematical concepts in

a way that is accessible and engaging to students. **Practicing specific teaching strategies:** For example, practicing different approaches to solving word problems or using manipulatives to illustrate geometric concepts.

Addressing common misconceptions in mathematics: By identifying and addressing potential misconceptions early on, teachers can improve student learning.

Despite its limitations, microteaching remains a valuable tool for teacher preparation, especially when combined with other forms of practical experience and mentorship. By acknowledging both the strengths and weaknesses of microteaching, educators can maximize its benefits for mathematics teachers in higher education.

9 Conclusions and future scopes

Microteaching for mathematics teachers in higher education offers significant benefits for both pre-service and experienced teachers, enhancing their skills, confidence, and overall effectiveness in the classroom. Microteaching, a scaled-down teaching encounter, provides a valuable platform for mathematics teachers to refine their skills. It allows them to practice specific teaching techniques, receive constructive feedback, and build confidence in a safe and controlled environment. For mathematics teachers in higher education, microteaching can focus on skills like explaining complex concepts, using visual aids effectively, and adapting to various learning styles. By focusing on individual skills and providing targeted feedback, microteaching helps mathematics teachers become more proficient and adaptable in their teaching practice.

Future scope includes integrating technology, personalized feedback, and addressing diverse learning needs through microteaching strategies. Microteaching can be enhanced by incorporating technology, such as interactive whiteboards, online simula-

tions, and digital assessment tools, to create more engaging and effective learning experiences. Virtual microteaching environments can also provide access to diverse learning resources and facilitate collaboration among mathematics teachers in higher education from different locations. Future microteaching models should emphasize personalized feedback from peers, mentors, and even students, focusing on specific areas of improvement for each mathematics teacher in higher education. Encouraging reflective practice through journaling and self-assessment can further enhance the impact of microteaching on teacher development. Future research can explore the effectiveness of microteaching in addressing specific mathematical concepts, such as algebra, geometry, or calculus, and develop targeted micro-teaching modules for these areas. As education transitions to more hybrid and online models, microteaching can be adapted to these contexts, allowing teachers to practice delivering lessons in different formats and develop skills for engaging students in online learning environments.

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