



Research paper

Development of research skills through research-focused microteaching lesson study in preservice teacher education

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ABSTRACT

This article presents the findings of an action research project that developed, implemented, and analyzed the efficacy of a model combining microteaching lesson study with research-focused activities. The research involved 45 preservice student-teachers. Data were collected from their research reports, and their research skills, individual differences, and experiences were examined using statistical and content analysis. The student-teachers performed better at analyzing the microteaching lesson study than at formulating research aims and questions, drawing conclusions, or conducting literature reviews. The research-focused microteaching lesson study helped them connect theory with practice, develop pedagogical knowledge, and become familiar with research-based teaching practice.

1. Introduction

A primary objective of teacher education (TE) is familiarizing prospective teachers with research-based professional practice and, training those capable of continuously improving their teaching and engaging in reflective teaching practices (Afdal & Spernes, 2018; Munthe & Rogne, 2015). These activities require teachers to have the requisite research skills to plan, implement, analyze, and evaluate instructional processes (Byman et al., 2021), and enhance their effectiveness (Vetter, 2012). To support professional teacher development, lesson study (LS), a highly valued practice by Japanese teachers having its origins in Japanese elementary education (Cerbin & Kopp, 2006; Fernández, 2010; Lewis, 2002), has recently been incorporated into some TE programs (Bjuland & Mosvold, 2015; Cajkler & Wood, 2016). LS includes repeated cycles of planning, implementing, analyzing, and revising research lessons (Lewis, 2002); it is a specific form of practice-oriented classroom action research (AR) (Austin, 2017; Dudley, 2015). AR and LS aim to improve instructional practices; AR examines specific classroom research questions, while LS allows teachers to conduct AR collaboratively (Kana-geswari et al., 2020), identifying and analyzing specific aspects of lessons and sharing the findings with colleagues (Makinae, 2010). During LS cycles, participants are given opportunities to integrate educational research into their teaching process (Álvarez et al., 2019) by gathering information in planned, systematic, and organized ways from various perspectives (e.g., student-teachers (STs), pupils, school mentors, teacher educators, and researchers) to investigate a practical

problem and improve teachers' professional knowledge (Elliott, 2019a).

A pedagogical approach that could support professional development in preservice TE programs is microteaching lesson study (MLS), a model combining elements of microteaching and LS (Fernández, 2005). MLS includes cycles of collaborative planning, teaching, lesson observation, and ongoing revision (Fernández, 2010); the outcomes are summarized in reflective research reports (Fernández, 2010; Griffiths, 2016). Previous research found MLS effective for learning to teach science (Bahçivan, 2017), physics (Danday, 2021), history (Utami et al., 2016), and mathematics (Elbehary, 2019; Fernández, 2010; Fernández & Robinson, 2006; Kurt & Çakıroğlu, 2023; Molina et al., 2011), and several MLS adaptations were developed, including active and passive MLS (Danday, 2019, 2021), peer MLS (Griffiths, 2016), and online MLS (Handayani & Triyanto, 2022). MLS may also benefit from learning AR principles and processes through collaborative planning, implementation, reflection, and revision of MLS lessons since previous studies conducted in preservice TE revealed that MLS and AR helped STs bridge the gap between theory and practice (Griffiths, 2016; Bahçivan, 2017; Ulvik et al., 2018) and develop their pedagogical content knowledge, critical thinking, inquiry abilities, and professional capabilities (Danday, 2019, 2021; Ginsberg, 2023; Kennedy-Clark et al., 2018). However, less is known about the effectiveness of MLS in preparing STs for research-based teaching practice and supporting them to incorporate classroom AR and improve their instructional practices. Investigating these issues requires further MLS adaptations, which may be feasible because previous studies indicated that “MLS has the potential to be adjusted in various ways for success in other courses and settings”

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Abbreviations

AR	action research
LS	lesson study
MLS	microteaching lesson study
ST	student-teacher
TE	teacher education

(Fernández & Robinson, 2006, p. 214). Future interdisciplinary findings may also identify other advantages of implementing MLS in preservice TE in other domains (Bahçivan, 2017).

This study contributes to existing MLS research by presenting the findings of an AR project conducted in the context of a compulsory subject in a preservice TE program, at a Hungarian university. To develop their research skills, the STs were introduced to research-based practices that instructed them on applying research methods to their instructional practice. This AR developed, implemented, and analyzed the concept of *research-focused MLS* that follows MLS principles and includes various research-focused activities in MLS cycles. As part of this subject, each participant prepared a reflective research report. This study investigated how STs summarized the research-focused MLS process in their research reports and examined their self-reported experiences with this MLS adaptation when applying their research skills.

The following sections review the literature on the goals of research-based TE and commonly used methods in pre- and in-service TE, including LS, microteaching, MLS, and AR. These methods incorporate research activities in different ways and to varying degrees to help TE students become reflective and inquiry-oriented. The article also describes the concept and implementation of research-focused MLS and includes the research aims and questions before presenting the results and discussing the findings.

2. Theoretical background

2.1. Research-based teacher education

An important goal of TE is to support prospective teachers in acquiring research-based teaching practice by developing the knowledge, skills, and attitudes required for research-based thinking (Munthe & Rogne, 2015); this enables them to use their research competencies in teaching and educational decision-making (Brew & Saunders, 2020; Kansanen, 2003) and significantly enhances teachers' effectiveness (Vetter, 2012). Research-based teaching entails teachers interpreting their instruction as AR (Kansanen, 2003), which may shorten the process of producing scientific findings and applying them in classroom settings (Manfra, 2019). To achieve this, teachers must have relevant and applicable knowledge of the most recent research findings in the subjects they teach (Kansanen, 2014; Niemi & Jakku-Sihvonen, 2006). Through reading research literature, teachers get to know, interpret, and monitor findings, and apply the lessons learned (Toom et al., 2010) in addressing their instructional practice problems by adopting identified research findings to their specific contexts (Cain, 2015). Teachers also must be familiar with research methodology to interpret their teaching as AR, i.e., to identify development opportunities, continuously revise and improve their instructional practices, and reflect on and share findings with colleagues (Eklund, 2014; Kansanen, 2003; Manfra, 2019; Munthe & Rogne, 2015; Toom et al., 2010; van Katwijk et al., 2019; Vetter, 2012). These activities require understanding qualitative, quantitative, and mixed research methods and positive attitudes toward research (Kansanen, 2003). Educating prospective teachers to become researchers or even teacher-researchers is not the objective of TE (Kansanen, 2003, 2014; Toom et al., 2010). Acquiring the skills to apply research to their teaching requires a research-based approach, i.e.,

integrating research-focused activities into TE courses and school-based teaching practices (Afdal & Spernes, 2018; Bayrak Özmütlu, 2022; Byman et al., 2009; Munthe & Rogne, 2015).

Thus, ultimately, research-based TE aims to help STs become pedagogically thinking, reflective, and inquiry-oriented teachers (Aras, 2021; Toom et al., 2010). Although the implementation and investigation of research-based TE are common in various study programs (Menter & Flores, 2021), there is debate about how research-based education should be interpreted and organized (Afdal & Spernes, 2018); the models developed by Griffiths (2004) and Healey (2005) can be used for these purposes. These models define four areas of research based on activities related to research content and process and TE student involvement and actions.

1. The primary goal of research-led TE is to provide opportunities for STs to learn educational research and research in their subjects by familiarizing them with the methods to explore the literature and conceptualize everyday classroom phenomena.
2. Research-oriented TE aims to develop STs' research skills and understanding of qualitative and quantitative research methods, techniques, and data analysis.
3. Research-based TE emphasizes undertaking research and inquiry by supporting STs to conduct small-scale research projects or AR during instructional practice.
4. Research-tutored TE engages STs in research discussions, which requires using specific vocabulary, research methods knowledge, and understanding of the relationship between theory and practice.

STs are frequently audience members in the former two types of engagement but active participants in the latter. These models have been used to select, organize, and analyze research-focused activities in a variety of TE courses and school-based teaching practices to provide frameworks for comparing research-based TE curricula, characterize specific TE programs, and investigate teacher educators' perceptions of and mentors' views on research-based TE and newly qualified teachers' understanding of research-based TE practices (Afdal & Spernes, 2018; Aspors et al., 2021; Byman et al., 2021; Jakhelln, Eklund, Aspors, Bjørndal, & Stølen, 2021; Munthe & Rogne, 2015; Pajchel et al., 2021).

2.2. Lesson study, microteaching, microteaching lesson study, and action research

LS is a professional development practice; at its heart is a practical problem identified by a teacher group and investigated through a literature review and empirical research (Fernandez, 2002; Lewis, 2002; Lewis et al., 2009). Teachers collaborate in different LS cycles to formulate learning goals and design research lessons, which LS group members implement while the others observe. They then analyze the evidence, repeat the process, and document the LS in their research reports (Cerbin & Kopp, 2006; Dudley, 2015; Elliott, 2019b; Follmer et al., 2023). Analytic reflection and ongoing revision of the research lessons contribute to changing teachers' professional learning, developing their content and pedagogical content knowledge (Cheung & Wong, 2014; Seleznyov, 2019), and their professional development by learning from one another and involving other expert advisors (Coenders & Verhoef, 2019; Ko, 2019). The LS approach has been implemented in some preservice TE programs, school-based practice, and initial and inservice TE (Bjuland & Mosvold, 2015; Cajkler & Wood, 2016; Kanellopoulou & Darra, 2019; Munthe et al., 2016), and several studies have verified its effectiveness (e.g., Angelini & Álvarez, 2018; Botes et al., 2022; Martin & Clerc-Georgy, 2015; Myers, 2012; Næshheim-Bjørkvik et al., 2019; Pérez Granados et al., 2022; Sims & Walsh, 2009). These studies found that LS implementation supported the development of teacher trainees' critical and reflective thinking, contributed to their pupil learning process, and enhanced positive attitudes and beliefs toward using LS during instructional practices

(Kanellopoulou & Darra, 2019). However, as Bjuland and Mosvold (2015) pointed out in their analysis of challenging cases, these positive effects can be achieved when STs approach research lessons as researchers by formulating research questions related to their LS learning and planning and conducting structured observations. It is also necessary to closely observe pupil learning by choosing the most appropriate LS structure.

Microteaching aims to develop STs' teaching skills and strategies (e.g., formulating clear instructions, effectively asking questions, and appropriately utilizing wait time) (Fernández, 2005; Grossman, 2005) and enhance their instructional experiences before starting practice in real classes (Imaniah, 2019; Ismail, 2011). Microteaching entails prospective teachers planning to teach a topic that covers small subject content, primarily individually and eventually in pairs or small groups. Then, in about 5–20 min, one group member presents the planned lesson to a small group of peers while the others observe (the lesson may be videotaped) and analyze the instructional practices together with the course instructor (Fernández, 2005, 2010). Although microteaching creates a simplified, controlled, safe, and artificial learning environment (Bahçivan, 2017; Bell, 2007; Danday, 2019), it can be effective in developing STs' pedagogical content knowledge (Etkina, 2010; Maguire, 2023; Niess, 2005; Subramaniam, 2022), self-reflection (Alamri & Alfayez, 2023; Donnelly & Fitzmaurice, 2011; I'Anson et al., 2003; Park, 2022), self-efficacy (Arsal, 2014; d'Alessio, 2018; Mergler & Tangen, 2010), and critical analysis of instructional practices (Bakir, 2014; Ismail, 2011; Remesh, 2013).

MLS combines microteaching and LS principles; this model, like LS, includes collaborative and recursive cycles of lesson planning, implementation, analysis, and revision (Fernández, 2005). Similar to microteaching, prospective teachers teach their MLS lessons to small groups of peers; however, contrary to microteaching, STs collaborate in planning their ~30-min MLS lesson in which they teach unfamiliar content to their student-peers, allowing MLS group members to experience authentic teaching in a simplified setting (Fernández, 2010). During MLS cycles, STs are engaged in self and peer assessment of their group lessons (Fernández, 2005), and similar to LS, they can seek an external expert's help, usually a teacher educator, to analyze and revise their MLS lessons. Empirical studies replicating these procedures have indicated that MLS is effective in developing STs' teaching skills and strategies, pedagogical content knowledge, subject matter knowledge, critical thinking, and knowledge of learners (e.g., Bahçivan, 2017; Danday, 2019, 2021; Fernández, 2005, 2010; Fernández & Robinson, 2006; Griffiths, 2016; Molina et al., 2011; Utami et al., 2016). These studies have also verified that MLS provides STs with opportunities to practice, analyze, and reflect on teaching and gain experiences that help them connect theory to practice and foster collaboration and revision.

AR models, based on their core elements, involve several iterative cycles, including problem identification, inquiry planning, data collection, analysis, and reflective decision-making (Elliott, 1996; Macintyre, 2000; O'Leary, 2004; Whitehead & McNiff, 2006). AR is a form of practitioner inquiry that aims to improve teaching and strengthen student learning (Cochran-Smith & Lytle, 2009). One of the TE goals could be introducing AR in research methodology courses and applying these steps in teaching practice through small-scale research projects (Cochran-Smith et al., 2009; Demircioglu, 2008; Kansanen, 2003; Pesti et al., 2018). To conduct the research, TE students must acquire research skills, including analyzing a practice-related problem, conducting a literature review, formulating research questions, selecting and using research methods, collecting and analyzing data, drawing conclusions, and writing a research report (Munthe & Rogne, 2015; van Katwijk et al., 2019). Empirical studies on preservice TE found that ST research attitudes and basic research skills, such as interpreting the literature, selecting suitable research methodology, and solving classroom problems, can be developed through subject-related education research (Counsell et al., 2000; Martinovic & Dabaja, 2023; Pendry & Husbands, 2000), AR (Aras, 2021; Bendtsen et al., 2021; Hatch et al., 2006;

Toquero, 2021), and small-scale research projects (Demircioglu, 2008; Dobber et al., 2012; Mak et al., 2023). AR promotes preservice STs' professional development (Ulvik, 2014) by developing their critical inquiry abilities (Ginsberg, 2023) and perceived research capacity (Martinovic & Dabaja, 2023) to connect theory and practice (Junor Clarke & Fournillier, 2012; Ulvik et al., 2018), and they take a more reflective approach to their teaching (Kennedy-Clark et al., 2018; Kosnik & Beck, 2000) if their overall AR experience is positive (Davis et al., 2018). Parallely, "conducting research is described as a promising activity in educating student teachers, but only when it is done in a purposeful, deliberate and reflective way, embedded in a program that highlights inquiry of teaching as a continuous part of practice" (Dobber et al., 2012, pp. 609).

Using LS and MLS, STs produce multiple products, including collaboratively planned and revised lesson plans, teaching materials, and reflective research reports. By writing LS reports, prospective teachers document the process, thus summarizing the goals, results, challenges, and conclusions (Cerbin & Kopp, 2006), and detailing the effectiveness and difficulties of the LS (Sims & Walsh, 2009). The reports usually consist of three parts: the theoretical background with the literature review results, the LS process, and teacher candidates' findings, reflections, and experiences (Angelini & Álvarez, 2018). The first two sections are usually guided by prespecified, explained, and practiced aspects of what and how to report, and in the third section, STs reflect on what they learned and considered important in the lesson (Santagata et al., 2007). During AR, participants prepare research plans and research reports comprising an introduction, theoretical and empirical parts, a discussion, and conclusions (Ulvik, 2014). Each part of these reports can be assessed based on different criteria (Demircioglu, 2008), the quality of which can be determined using content analysis (Cochran-Smith et al., 2009). Writing reports on the LS, MLS, and AR processes and outcomes can enhance the STs' reflectiveness, the development of which may show large individual differences (Bahçivan, 2017; Coenders & Verhoef, 2019; Eklund, 2014; Fernández, 2010; Fernández & Robinson, 2006; Myers, 2012; Sims & Walsh, 2009). To determine reflective abilities, Hatton and Smith (1995) classify texts into descriptive writing, descriptive reflection, dialogic reflection, and critical reflection. This framework can also be used to examine report quality (Fen et al., 2017; Myers, 2012; Suratno & Iskandar, 2010).

3. Context of the study

3.1. The investigated teacher education program

The present study was conducted within the context of the Hungarian TE program that prepares STs for lower (K5–8) or upper secondary (K9–12) teaching. This master's degree-level program is five years for lower secondary teachers and six years for upper secondary teachers (Kopp & Kálmán, 2023). At the beginning of their studies, the STs must select two major disciplines. The pedagogical–psychological preparation is delivered in the first three years to all STs, after which the STs decide on further lower or upper secondary preparation in their subject fields. The school-based teaching practicums take place in the last two semesters (Pesti et al., 2017). Common requirements regulate the study program at each TE institution. These outcome requirements define the knowledge, skills, and attitudes required of teachers in eight fields of competence at the end of their training (Ministry of Human Capacities of Hungary, 2013).

TE institutions have incorporated teacher research into their curricula, but in different ways and to different degrees due to the autonomy institutions have in developing their study programs (Pesti et al., 2018). One aim of the examined TE institution is preparing STs for research-based teaching practice. This has been implemented in educational and psychological subjects and, to varying degrees, in subject methodology courses through tasks and activities within university coursework (e.g., following and discussing general and

subject-related educational research and developments, solving practical tasks related to research activities, analyzing and reflecting on lessons, etc.) and during the teaching internship.

To conclude their preservice studies, STs prepare a portfolio and an MEd thesis. In the portfolio, they are expected to demonstrate that they can integrate the knowledge gained in various areas of the TE program, collect findings from the scientific literature that are relevant to their teaching practice, and independently plan, implement, and revise their teaching by collecting data about their pupils' achievements and development, analyzing the results, and reflecting on the findings. The portfolio must include a methodological literature review, demonstrating their ability to analyze an educational problem identified during their practicum by reviewing the relevant literature. STs can write their MEd thesis on any topic of their choice that is related to a scientific discipline or teaching methodology of one of their subjects, or to education or psychology. In this process, they can prepare a small-scale research project during their school-based teaching practice, which is often conducted independently of their supervisors' support (Pesti et al., 2018). Therefore, STs are expected to conduct a literature review, demonstrate their ability to collect data systematically (e.g., through observations, interviews, questionnaires, or tests), analyze the results, draw conclusions, and apply the findings in their teaching.

3.2. Adaptation and use of research-focused microteaching lesson study in the present study

This study was conducted on a TE subject titled *Methods of Educational Research and the Application of Scientific Findings at School*. This was a compulsory subject for all third-year STs who had completed all other education and psychology subjects and learned the basics of planning, teaching, and assessment; thus, they have novice teacher knowledge. The subject's objectives, learning outcomes, teaching principles, and completion conditions were determined and developed by instructors through collaborative planning and continuous cooperation. The objectives included developing research skills, increasing reflectivity in teaching, and improving collegial communication and cooperation. These objectives were achieved by assigning teaching and research tasks to be completed in small groups and individually. The subject was carried out for 15 weeks in 90-min weekly class sessions. To investigate the effectiveness of the subject, the instructors collaboratively conducted different AR programs.

The AR presented in the current study used the concept of research-focused MLS, a model that combines MLS principles and cycles (Fernández, 2010; Fernández & Robinson, 2006; Griffiths, 2016) with various TE models of student engagement with research (Griffiths, 2004; Healey, 2005). This concept was developed through the successful implementation of MLS in various methodological courses in preservice

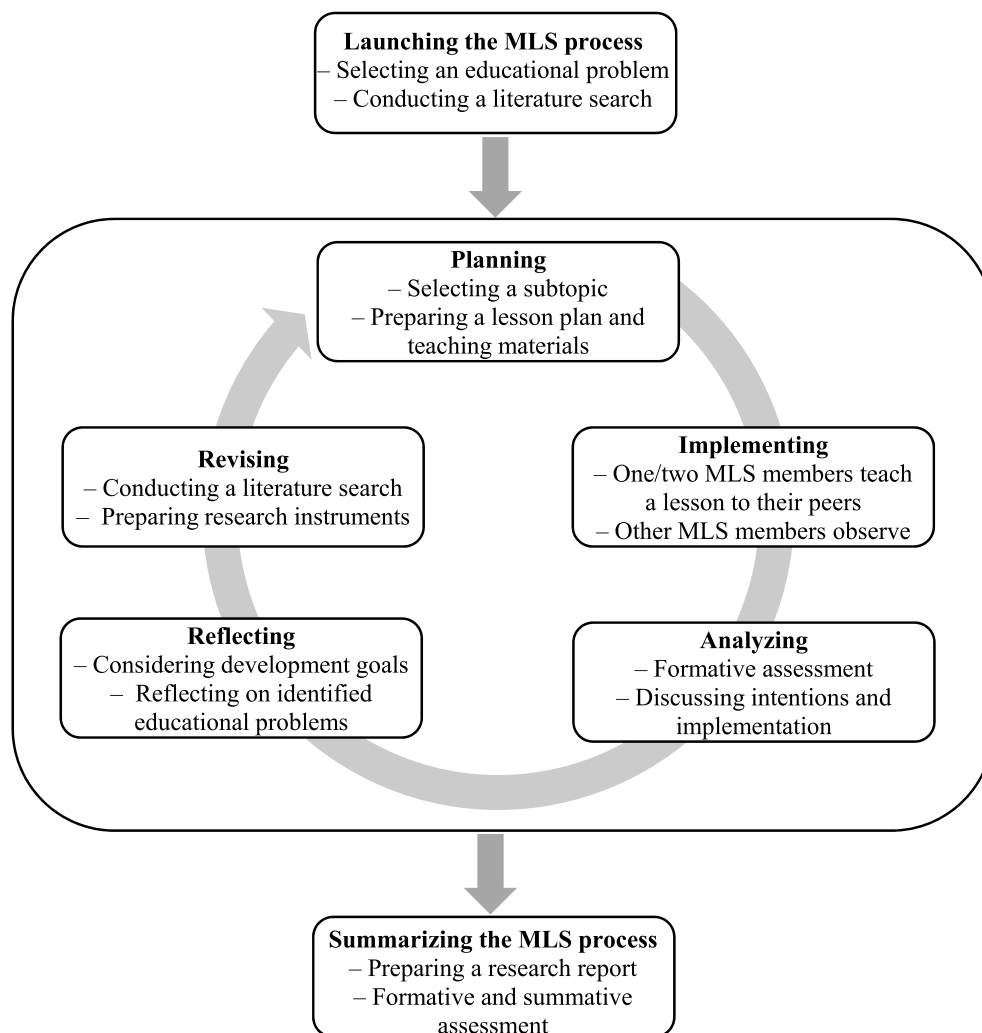


Fig. 1. Research-Focused Microteaching Lesson Study Process Used in This Study.

Notes. MLS, Microteaching lesson study. Revising occurred only during the first MLS cycle.

TE (e.g., Bahçivan, 2017; Fernández, 2010; Fernández & Robinson, 2006; Molina et al., 2011; Utami et al., 2016), the efficient development of different MLS adaptations (Danday, 2019, 2021; Griffiths, 2016), and the call for adapting MLS to other contexts in different ways (Bahçivan, 2017; Fernández & Robinson, 2006). Combining MLS with research-focused activities was intended to be implemented purposefully and reflectively at the beginning, during, and after MLS cycles. Fig. 1 provides an overview of the phases, stages, and activities. The research-focused MLS involved three phases: (1) MLS process launch, (2) two MLS cycles, each comprising planning, implementing, analyzing, reflecting, and revising stages, and (3) MLS process summarizing.

3.2.1. Launching the research-focused microteaching lesson study process

Research-led teaching and learning activities were planned and implemented during the first phase to achieve three purposes. First, to familiarize STs with the importance, principles, and processes of MLS and AR, before the first MLS cycle, participants discussed readings offered by the instructor and analyzed videotaped lessons, and the instructor modeled these processes as well. Second, to identify their investigated educational problem, discussions were held with the STs on possible topics, after which small MLS groups were formed based on common interests. The chosen topics included motivation, gamification, learning strategies, and the use of graphic organizers for learning. Third, to support STs in conducting a literature review on the selected topic and to develop pedagogical content knowledge, STs learned how to explain the chosen topic's relevance, formulate research aims and questions, and identify and summarize relevant sources.

3.2.2. First research-focused microteaching lesson study cycle

3.2.2.1. Planning. STs in groups of three or four planned to teach selected elements of their chosen educational topic to student-peers who were examining other topics. With the instructor's support, the MLS group members defined the small research project's common aims and questions, collaboratively designed a lesson plan, prepared teaching materials, and summarized the potential instructional and educational problems that might occur while teaching the lesson.

3.2.2.2. Implementing. In one class session, one or two members of the MLS group taught their peers based on the common lesson plan, while the others observed. The implementation took approximately 20–25 min; MLS group members commonly decided and agreed on fulfilling the roles of teacher or observer. The lessons were not videotaped; the implementation phase aimed to identify potential problems for each group member that could be researched individually.

3.2.2.3. Analyzing. The analysis phase occurred immediately after the lesson was taught. The instructor prepared assessment sheets that were worded differently for the student-peers, the MLS group members, and the observers, but covered the same questions. Their objective was to discuss the quality of teaching (positive elements and areas for improvement), the relationship between learning goals and outcomes, and the lesson plan created by the MLS group. After completing the written assessment, an oral evaluation was conducted in class. During this discussion, the MLS group members presented the background of their lesson plan, and their intentions and perceived implementation were examined to identify developmental needs and educational problems for improving the first lesson.

3.2.2.4. Reflecting. After each class session, STs wrote either reflective self-assessments on their first MLS lesson or formative peer feedback reflecting on their experiences as learners, which was shared anonymously with other MLS groups. The instructor assisted the STs in formulating the self-assessments and peer feedback. STs also identified development goals and, based on them, defined their individual research

tasks, focusing on instructional and educational problems related to educational planning, learner-centered teaching methods, and formative assessment. The STs' research subtopics were different within each MLS group.

3.2.2.5. Revising. To support STs in revising and improving their lesson based on formative feedback and research tasks, in the second half of the course, research-oriented and research-tutored activities were planned and implemented. The research-oriented activities aimed at developing ST research skills, understanding research methods (such as observations, questionnaires, and methods for analyzing teaching materials), and knowledge of basic data analysis related to descriptive statistics. Before the second MLS cycle, STs developed research questions for their research subtopic, conducted literature reviews, and prepared data collection instruments. The aims of research-tutored activities were to engage STs in research discussions and help them acquire vocabulary to discuss findings. Through discussions and formative feedback sessions, participants shared the initial literature search results and their experiences preparing the research instruments with their MLS group members and learned how to prepare a research report.

3.2.3. Second research-focused microteaching lesson study cycle

3.2.3.1. Planning. The small group members planned another MLS lesson based on the first lesson's research findings and feedback. Because the number of STs in the learning groups was limited, they did not plan their lesson for other student-peers on the same content but for the same peers. Thus, to experience authentic teaching in a simplified classroom setting, they either selected a different subtopic of the larger educational content or kept the first lesson's topic but had to use different methods; for instance, instead of using a teacher-centered approach, they planned to apply learner-centered methods to gain a deeper understanding of the content.

3.2.3.2. Implementing. As in the first MLS cycle, group members taught their improved lessons in each class session, during which the other members observed their practice using a self-developed set of observational criteria. MLS members commonly agreed to take the role of teacher or observer; they were not required to have the same ST teach both lessons.

3.2.3.3. Analyzing. To involve STs in research-based activities, in contrast to the first cycle, after the implementation, they collected data from their peers about the effectiveness of teaching practice, for example, using assessment sheets with their questions. After data collection, they compared their lesson's learning objectives and outcomes and discussed the effects of the changes.

3.2.3.4. Reflecting. To engage the STs in the research-tutored activities, the members of the small group reflected on the MLS process and gave oral presentations of their research project's objectives, the group- and individual-level research questions, and the conclusions of their literature searches. They also compared these experiences with the two MLS lessons. The MLS group members conducted these activities in one class session, which was followed by a common discussion facilitated by the instructor.

3.2.3.5. Revising. Unlike the first MLS cycle, the STs were not required to revise their second MLS lesson. However, based on the experiences gained from the second MLS cycle, when summarizing the MLS process in their research reports, they could consider possible changes.

3.2.4. Summarizing the research-focused microteaching lesson study process

Each ST wrote an individual reflective research report documenting

the MLS conducted during the course. They were required to present the research aims and questions, literature review findings of the selected educational topic, MLS lesson analysis results, and conclusions in about 2000–2500 words. The instructor provided guidelines, assessment criteria, and formative assessment while compiling their research reports. The reports were evaluated using an evaluation scheme (Table 1).

3.3. Aims and research questions

This study aimed to (1) analyze STs' reflective research reports to assess the development of their research skills on generating research aims and questions, presenting literature reviews, analyzing research lessons, formulating conclusions, and handling references, (2) identify differences in applying these research skills, and (3) examine their experiences with research-focused MLS. These aims were operationalized by addressing the following research questions:

1. How did STs present the elements of the research process in their reports?
2. What are the differences in the quality of research reports?
3. What experiences did STs report about MLS characteristics and cycles?

4. Methodology and methods

4.1. Sample

Six instructors taught 191 third-year STs, who were divided into thirteen learning groups. The university's Registrar's Office randomly assigned the STs to the groups based on their respective disciplines. The researcher was a subject instructor for four learning groups, each of which had between 12 and 16 STs.

The course description and activities were the same for all four learning groups. To ensure confidentiality, the STs were asked to give their informed consent for the analysis of their research reports after term grades were registered and were informed that their data were anonymous and there would be no consequences if they refused. Out of the 51 STs, 45 ($n_1 = 14$, $n_2 = 7$, $n_3 = 12$, and $n_4 = 12$) granted permission to the researcher to examine their research reports. These STs were also requested to fill out a short background questionnaire to characterize the sample. Fifty-one percent of the STs majored in humanities and social sciences, 27% majored in two science disciplines, and 22% selected an interdisciplinary major. This distribution did not differ significantly from the population, $\chi^2(2) = 2.80$, $p = 0.25$. Seventy-nine percent have mostly informal teaching experiences, while eight reported having formal, organized, and regular teaching practices. When the STs were asked if they wanted to work as teachers, 73% responded in the affirmative, indicating that most respondents were committed to this profession.

4.2. Criteria for examining reflective research reports

To ensure content validity, the evaluation scheme was developed based on previous studies that had analyzed research reports (Cerbin & Kopp, 2006; Demircioglu, 2008; Sims & Walsh, 2009). The research-focused MLS was adjusted to include the research skills components. As shown in Table 1, all parts of the research reports were evaluated. Thus, the evaluation scheme for content analysis applies to the 10 structural units of the research report and includes 31 questions; eight questions evaluated a dichotomous scale of 0 or 1 while the other 23 questions were used to judge whether the report satisfies, partially satisfies, or does not satisfy the question on a three-point scale, ranging from 0 to 2. The items were assigned to five evaluation criteria as shown in Table 2. The quality of the research report was indicated through a composite score of up to 54 points. To ensure the evaluation scheme's face validity, transparency, and acceptance, the STs evaluated an

Table 1

Evaluation scheme for reflective research reports.

Examined questions belonging to structural units of the research report	Max. score	Mean (%)
<i>Introduction</i>		
1. Has the author specified the research topic investigated by the MLS group?	1	95.6
2. How precisely and thoroughly has the author explained the relevance of the chosen topic?	2	80.0
3. Has the author summarized the aims of the MLS project?	1	91.1
4. How detailed is the justification of the aims?	2	68.9
5. How appropriate are the research questions?	2	35.6
<i>Review of the literature on the chosen educational topic</i>		
6. How precisely and thoroughly has the author defined the basic concepts used in the chosen educational topic?	2	56.7
7. To what extent does the literature review content correspond to the aims and questions?	2	47.8
<i>Goals of the first lesson</i>		
8. Has the author specified the learning goals of the first lesson?	1	95.6
9. To what extent do learning goals correspond to the research aims?	2	85.6
<i>Conclusions drawn from the first MLS cycle</i>		
10. How thoroughly has the author summarized the lesson tasks planned to investigate the research problem?	2	85.6
11. How informatively has the author summarized the lessons learned from the first MLS cycle regarding the research topic?	2	65.6
12. How informatively has the author summarized the lessons learned from the first MLS cycle regarding teaching?	2	81.1
<i>Aims and questions of the individual research task</i>		
13. Has the author specified the individual research subtopic and aims?	1	91.1
14. How thoroughly has the author explained the relevance of the chosen subtopic and aims based on the first MLS experiences?	2	70.0
15. How appropriate are the research questions?	2	44.4
<i>Review of the literature on the chosen individual subtopic</i>		
16. How thoroughly has the author defined the basic concepts used in the chosen subtopic?	2	45.6
17. To what extent does the literature review content correspond to the individual research aims and questions?	2	44.4
18. To what extent does the literature review provide answers to the research questions?	2	32.2
<i>Using findings to plan the second MLS cycle</i>		
19. How adequately has the author summarized the lessons learned from the individual research task and incorporated them in planning the second lesson?	2	63.3
20. How thoroughly has the author summarized the individual developmental goal concerning the research topic?	2	83.3
<i>Analysis of the implementation of the second MLS cycle</i>		
21. How thoroughly has the author summarized the research methods used to examine developmental goal fulfillment?	2	67.8
22. Has the author specified the extent to which the developmental goal was achieved during the second MLS cycle?	1	97.8
23. How informative is the summary of the developmental goal fulfillment?	2	65.6
<i>Summary</i>		
24. Does the author formulate the experiences gained during the MLS cycles?	1	97.8
25. How thoroughly has the author explained the experience gained during the MLS cycles?	2	71.1
<i>Handling references</i>		
26. Are there any in-text citations in the text?	1	73.3
27. How appropriate are the in-text citations?	2	50.0
28. Is there a reference list at the end of the text?	1	100.0
29. How appropriate is the reference list?	2	78.9
30. To what extent are the in-text citations in line with the reference list?	2	54.4
31. To what extent has the author realized the literature synthesis?	2	44.4

Note. MLS, Microteaching lesson study.

Table 2

Characteristics, reliability, and internal correlations of the evaluation criteria.

Criteria	Question number	Total score	Cronbach's alpha	Correlations			
				1	2	3	4
1. Formulating research aims and questions	1, 2, 3, 4, 5, 13, 14, 15	13	0.73	–			
2. Writing literature review	6, 7, 16, 17, 18, 31	12	0.88	0.75	–		
3. Analyzing MLS lessons	8, 9, 10, 21, 22, 23	10	0.68	0.57	0.70	–	
4. Drawing conclusions	11, 12, 19, 20, 24, 25	11	0.77	0.72	0.77	0.72	–
5. Handling references	26, 27, 28, 29, 30	8	0.74	0.53	0.75	0.62	0.66

Note. MLS, Microteaching lesson study. The numbers given in the second column indicate the serial numbers of the questions included in Table 1. In case of all correlations, $p < 0.001$.

example research report in a class session.

The Cronbach's alphas for all criteria were acceptable (Table 2). To investigate convergent validity, item-total and internal correlations were calculated. When analyzing item-total correlations, the correlations between each criterion and the overall research report quality index were fairly strong, positive, and significant ($r > 0.81$, $p < 0.001$), and all criteria contributed nearly equally to the total composite score ($0.18 \leq \beta \leq 0.30$, $p < 0.001$). Most of the internal correlations were moderate, positive, and significant, indicating that the data are not characterized by multicollinearity; thus, the criteria can be interpreted individually, which represent different activities allowing the assessment of research skills in five areas.

4.3. Data analysis

The research reports were analyzed in three phases using a mixed research design comprising quantitative and qualitative methods.

4.3.1. Quantitative analyses

First, the statistical analyses examined the quality of the presentation of the research-focused MLS process. All evaluation components were used to achieve this, including the total research report quality index, the scores of the five criteria, and the points for each item (Tables 1 and 2). All data were transformed into percentages for comparison, their descriptive statistical parameters were calculated, and differences between them were investigated using single-factor repeated measures analysis of variance (ANOVA) and a series of paired samples t-tests. Second, to examine the differences in the quality of the reports, the sample was divided into groups that performed differently and examined using multivariate and one-way ANOVAs based on the evaluation criteria using the Statistical Package for Social Sciences (IBM SPSS) V25.

4.3.2. Qualitative analyses

The third phase involved content analysis of STs' experiences about the lessons they learned and considered important to highlight after reporting the research-focused MLS processes at the end of their research reports. Their emphasis was examined using deductive qualitative analysis (Bingham & Witkowski, 2022), whose categories were derived from MLS characteristics (Fernández & Robinson, 2006) and cycles (Fernández, 2010). During the analysis, each text segment was assigned to the appropriate categories, and the ratios of these categories were established from two perspectives. The percentage of STs who

mentioned the given element from the two investigated aspects was calculated, followed by comparing the percentage of all text segments in the two categories. The MAXQDA software was used for the content analysis.

5. Results

5.1. Research question one

Table 3 presents the descriptive statistics of each evaluation criterion and the differences between the means of items within each criterion. When all five criteria's means were compared using single-factor repeated measures ANOVA, the difference between them was significant, $F(4, 175) = 42.17$, $p < 0.001$. Regarding the descending order of the criteria averages, pairwise comparisons revealed that analyzing MLS lessons had the highest mean ($M = 80.2\%$), while drawing conclusions had a significantly lower mean ($M = 75.2\%$), $t(44) = 2.01$, $p = 0.04$, which did not significantly differ from the average of formulating research aims and questions ($M = 70.4\%$), $t(44) = 1.84$, $p = 0.07$. The mean for handling references ($M = 67.5\%$) was significantly lower than that for drawing conclusions, $t(44) = 2.50$, $p = 0.02$. The average for the quality of the literature review ($M = 45.2\%$) was significantly lower than all other previously mentioned evaluation criteria ($p < 0.001$ in all cases). The large differences between the minimum and maximum values and the high standard deviations indicated that the sample was heterogeneous. As shown in Table 3, there were significant differences between the items within all evaluation criteria; thus, they were compared and grouped based on the means of the items. Each item's average is provided in Table 1.

There were significant differences in the averages between the individual items for formulating research aims and questions, which can be divided into three groups. The mean was above 90% for items 1, 3, and 13, which examined whether STs specified the research topics and aims. The means of items 2, 4, and 14, which evaluated the quality of the explanation of the selected topic's relevance and the justification of the aims, were significantly lower ($p < 0.01$), ranging between 68.9% and 80.0%. The lowest means were for items 5 ($M = 35.6\%$) and 15 ($M = 44.4\%$), which assessed the appropriateness of the research questions.

The difference between the averages of the individual items within the literature review criterion was the lowest of all evaluation criteria (Table 3), with means ranging between 32.2% and 56.7%. STs achieved the highest mean for item 6, evaluating the quality of defining the basic

Table 3

Descriptive statistics (%) for the evaluation criteria and internal differences between the items.

Criteria	Descriptive statistics				Differences between items			
	Min.	Max.	<i>M</i>	<i>SD</i>	<i>F</i>	<i>df</i> ₁	<i>df</i> ₂	<i>p</i>
Formulating research aims and questions	15.4	100.0	70.4	23.0	19.43	7	308	<0.001
Writing literature review	0.0	91.7	45.2	28.1	4.99	5	220	<0.001
Analyzing MLS lessons	10.0	100.0	80.2	20.4	14.09	5	220	<0.001
Drawing conclusions	18.2	100.0	75.2	22.8	12.14	5	220	<0.001
Handling references	12.5	100.0	67.5	26.3	25.32	4	175	<0.001

Note. MLS, Microteaching lesson study; Min, minimum value; Max, maximum value; *M*, mean; *SD*, standard deviation; *df*, degrees of freedom.

concepts of the research topic chosen by the small group, while the lowest average was for item 18, which assessed the extent to which STs' literature review answered the research questions. The remaining items, 7, 16, 17, and 31, had similar averages ranging between 44.4% and 47.8%.

Concerning analyzing MLS lessons, the items were arranged into three groups in descending order of their means. STs achieved the highest scores, ranging 95.6%–97.8%, for items 8 and 22, which examined whether the learning goals and the ways to achieve them were specified in the research report. The means for items 9 and 10 ($M = 85.6\%$)—evaluating the extent to which the learning goals corresponded to the research aims and how thoroughly the lesson tasks planned to investigate the research problem were summarized—were significantly lower, $t(44) = 2.66, p = 0.01$. The lowest averages were for items 21 ($M = 67.8\%$) and 23 ($M = 65.6\%$), which assessed the quality of the summaries of the methods for how the developmental goals were achieved and the summary on fulfilling these goals.

When assessing the criterion of drawing conclusions, the highest score was achieved for item 24 ($M = 97.8\%$), which examined whether the reports included the experiences gained during the MLS cycles. Compared to this item, the average for item 12, evaluating the reflection on teaching the first MLS lesson ($M = 81.1\%$), was significantly lower ($p < 0.003$), and as was that for item 20 ($M = 83.3\%$), assessing the summary of the development goal related to the research topic. Within this criterion, the means of items were significantly lower ($p < 0.001$), which assessed the quality of the explanation of the experiences gained during MLS cycles ($M_{25} = 71.1\%$), the conclusions drawn from the first MLS cycle about the research topic ($M_{11} = 65.6\%$), and the presentation of the lessons learned from the individual research task and their incorporation into planning the second lesson ($M_{19} = 63.3\%$).

For the references, the items were classified into two groups in descending order of their averages. All research reports contained a reference list ($M_{28} = 100.0\%$), which was mainly appropriate ($M_{29} = 78.9\%$), and most also included in-text citations ($M_{26} = 73.3\%$). Parallely, the averages from these items were significantly lower ($p < 0.001$) for the appropriateness of the in-text citations ($M_{27} = 50.0\%$) and their consistency with the reference list ($M_{30} = 54.4\%$).

5.2. Research question two

The total sample was divided into four almost equal groups, based on the research report quality index, to examine the differences between the research reports in greater detail. Table 4 contains the descriptive statistics for all groups as well as the differences between the means for each group. Multivariate ANOVA confirmed that the difference between the created groups was significant ($F = 1.58, p = 0.009$; Wilks' $\lambda = 0.05, p < 0.001$; partial $\eta^2 = 0.62$). Based on the results of both the one-way and the single-factor repeated measures ANOVA, the differences between the means for the four groups and within them were significant ($p < 0.001$) for all evaluation criteria. Each criterion's role was also significant in establishing the groups based on the F values ($20.70 \leq F \leq 65.06, p < 0.001$) and partial eta squared indices ($0.60 \leq \eta^2 \leq 0.83$),

indicating similar weights. Similar to the total sample, the differences between the means for the variables within certain groups were significant in every case ($7.23 \leq F \leq 18.70, p < 0.001$). Below, the description of each group is presented first, followed by the role of evaluation criteria in forming the between-group differences.

In the lowest-performing group, the criterion evaluating the literature review quality had the smallest mean ($M = 7.6\%$), and ST performance with handling references ($M = 33.0\%$) was significantly better, $t(10) = 6.07, p < 0.001$. Compared to this criterion, the mean of analyzing MLS lessons ($M = 52.7\%$) was significantly higher, $t(10) = 2.55, p = 0.03$, which did not significantly differ from the means of the two criteria of formulating research aims and questions ($M = 44.1\%$) and drawing conclusions ($M = 42.2\%$).

There were also significant differences between the evaluation criteria in the second performance group. The STs in this group performed significantly better than their peers in the lowest-performing group. The criterion of analyzing MLS lessons had the highest mean ($M = 85.0\%$), which differed significantly from drawing conclusions ($M = 75.5\%$), $t(9) = 2.58, p = 0.03$. The mean of formulating research aims and questions ($M = 61.5\%$) was significantly lower, $t(9) = 2.51, p = 0.03$, which was comparable to handling references ($M = 71.3\%$), $t(9) = 1.04, p = 0.33$. The mean of the literature review ($M = 35.0\%$) was the lowest of all the evaluation criteria ($p < 0.001$).

The achievement of STs in the third performance group differed from the previous two groups in two respects. First, averages were significantly higher for research aims and questions, literature review, and conclusions. Second, except for the quality of the literature review ($M = 61.3\%$), the means of the other criteria were around 80%, and pairwise comparisons revealed that the mean of the literature review was significantly lower than that of other evaluation criteria ($p < 0.02$).

In the highest-performing group, the mean of the literature review ($M = 74.2\%$) was the lowest of the averages of other evaluation criteria ($p < 0.001$). At the same time, they were above 85%, and only the averages of handling references ($M = 85.0\%$) and analyzing MLS lessons ($M = 96.0\%$) differed significantly, $t(9) = 2.75, p = 0.02$.

When examining the differences between the four groups (Table 4), the post hoc analyses of one-way ANOVA revealed that the means of each evaluation criterion differed significantly between the first and second performance groups. Since the averages for analyzing MLS lessons and handling references were already above 70% in the second performance group, there were no further differences between the groups in the case of these criteria. Regarding literature review and drawing conclusions, there were no significant differences between the means of the third and fourth groups. For formulating research aims and questions, STs belonging to a higher-performing group based on total score also tended to perform better, indicated by the significant differences between the four groups ($p < 0.05$ in all cases).

5.3. Research question three

As shown in Table 5, 86.7% of the STs highlighted that MLS was beneficial for connecting theory with practice; others provided either no

Table 4
Means and standard deviations for the evaluation criteria and differences between performance groups.

Evaluation criteria	Group 1 ($n = 11$)		Group 2 ($n = 10$)		Group 3 ($n = 14$)		Group 4 ($n = 10$)		Differences between means
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Formulating research aims and questions	44.1	15.4	61.5	13.6	79.7	15.6	95.4	4.4	{1} < {2} < {3} < {4}
Writing literature review	7.6	7.9	35.0	15.1	61.3	14.1	74.2	9.2	{1} < {2} < {3, 4}
Analyzing MLS lessons	52.7	20.5	85.0	9.7	87.1	9.9	96.0	4.2	{1} < {2, 3, 4}
Drawing conclusions	42.2	14.2	75.5	9.6	87.0	11.7	94.6	4.7	{1} < {2} < {3, 4}
Handling references	33.0	12.8	71.3	25.0	79.5	16.0	85.0	12.9	{1} < {2, 3, 4}

Note. MLS, Microteaching lesson study; *M*, mean; *SD*, standard deviation. The numbers in the last column refer to the four performance groups; < indicates the direction of the significant difference, $p < 0.05$, obtained during the one-way ANOVA post-hoc analysis using Tukey's-b test for the first, third, and fourth criteria, and Dunnett's T3 test for the rest.

Table 5

Frequencies for experiences highlighted by STs based on MLS characteristics and cycles.

Category	Text segments		Ratio (%) of STs *
	n	%	
<i>MLS characteristics</i>			
Connecting theory and practice	39	17.7	86.7
Collegial communication and cooperation	23	10.4	51.1
Development of research skills	17	7.7	37.8
Development of pedagogical content knowledge	25	11.3	55.6
Development of methodological knowledge	20	9.1	44.4
<i>MLS cycles</i>			
Planning	25	11.3	55.6
Implementing	31	14.0	68.9
Reflecting	29	13.1	64.4
Revising	12	5.4	26.7
Total	221	100.0	–

Note. MLS, Microteaching lesson study; STs, student-teachers. * The percentage indicates the ratio of STs mentioning the element in the given category in comparison to the total sample ($N = 45$).

summary or a rather schematic explanation, or they made criticisms of the time-consuming nature of MLS. Approximately half of the participants perceived and reported improvements in collegial communication/cooperation and pedagogical content knowledge, while around 40% of STs reported the perceived development of research skills and methodological knowledge. More than half of the respondents mentioned the observed development of the MLS cycles in planning, implementing, and reflecting, while only 26.7% referred to the lessons learned from the revision of MLS lessons.

Two-thirds of text segments were related to respondents' reported progress in connecting theory and practice, planning, implementing, and reflecting on MLS lessons, and developing content knowledge of the chosen educational topic. Comparing these responses with the course objectives revealed that in 7.7% of all text segments, participants reported they perceived their research skills improved, in 13.1%, there was an increase of reflectivity in teaching, and in 10.4%, collegial communication and cooperation improved.

6. Discussion

6.1. Development of research skills

The analysis of the research reports confirmed that STs who participated in the study performed better at analyzing MLS lessons than at formulating research aims and questions, drawing conclusions, and handling references; writing the literature review was the most challenging. To interpret these overall findings, the STs' item-level mean performances were divided into three categories: well ($78.9\% < M < 100\%$), moderate ($56.7\% < M < 73.3\%$), and poor ($32.2\% < M < 50\%$) solved items, allowing for discussion on research skills development.

The study found that many STs could specify a group and individual topic and explain the selected common topic's relevance. Most could also justify the goals of their common MLS lessons, summarize the planned tasks, and report shared development goals. Most reports portrayed experiences of research-based MLS related to highlighting lessons learned on teaching during the first MLS lesson and summarizing development goals related to the research topic at the group level. Therefore, the STs could summarize teaching and research-based and research-tutored activities they had completed in collaboration with their peers. These findings are consistent with studies that found teacher candidates had better outcomes and generally positive attitudes toward research-based activities (Byman et al., 2009; Jyrhämä et al., 2008; Puustinen et al., 2018) because they recognized their relevance in their instructional practices (Afdal & Spernes, 2018), the need for research

skills in their practical work (Byman et al., 2021), and the contributions that research activities make to their teacher identity (van Katwijk et al., 2019). This study suggests that providing collaboration opportunities to STs can assist them in developing their research skills when implementing research-focused MLS.

The STs' performances on the moderately-solved items revealed that many struggled to justify their research aims, thoroughly explain the relevance of their subtopics, precisely define the basic concepts used in the chosen educational topic, and properly present research methods to achieve developmental goals. Most participants had difficulties with revising the MLS lessons, formulating the lessons learned from the research activities, and drawing general conclusions from the MLS process. These findings indicate STs' difficulties in reporting research-led and research-oriented activities. The lower-level performances in the present study may also be explained by previous research findings that STs considered research-led and -oriented TE courses to be abstract and irrelevant to teaching (Afdal & Spernes, 2018). Preservice teachers often found these activities frustrating and stressful, doubted that they would ever conduct research in their future work as teachers (van Katwijk et al., 2019), felt that TE did not adequately prepare them for tasks that were directly occurring or that they needed to know in school practice (Eklund, 2014), and encountered challenges in bridging the gap between theory-oriented education in their studies and practical teaching experiences in schools (Puustinen et al., 2018). Thus, teacher candidates need long-term support to develop these research skills.

When writing their research reports, most STs could not formulate appropriate research questions or adequately respond to them. Bjuland and Mosvold (2015) emphasized that developing appropriate research questions is critical to successful and Cochran-Smith et al. (2009) found that the quality of teacher candidates' inquiries was largely determined by the questions that had been formulated. Therefore, STs require purposeful support to develop clear, researchable questions. Most participants also had difficulties writing a literature review that corresponded to their aims and questions, defining the basic concepts for the individual research subtopic, and synthesizing literature. These issues could have been because of a lack of effective strategies for identifying, purposefully comprehending, and critically analyzing relevant sources. Previous research also found that preservice STs often use limited reading strategies (Akyol & Ulusoy, 2010) and have difficulties transferring strategy use to teaching (Klapwijk, 2016) and applying genre-specific reading strategies when reading journal articles, which they find more challenging than reading textbooks or newspaper articles (Mawyer & Johnson, 2019). Therefore, targeted assistance is required to support STs to learn how to effectively read and synthesize scientific literature.

6.2. Differences in applying research skills

The analysis of the STs' research reports revealed large individual differences in their research skills. Cochran-Smith et al. (2009) also identified differences in the quality of teacher candidates' inquiry papers, particularly in formulating research questions and analyzing and interpreting classroom data.

Unlike previous MLS studies that examined implementation in the whole sample, the present work examined the quality of research reports across different groups. Examining differences and challenging cases can provide more specific pieces of information on the efficacy of LS (Bjuland & Mosvold, 2015) or MLS. Therefore, since the sample was heterogeneous for each evaluation criterion, it was divided into four groups using the research report quality index. The performances of these groups are discussed by comparing the results to Hatton and Smith's (1995) levels of reflection.

In the poorest-performing group, STs struggled with implementing the research-focused MLS, which was barely successful as the averages of all evaluation criteria were around or below 50%, and the reports did not present a literature review. Although STs attempted to provide some

reflection and explanations for perceived events and experiences, this tended to be descriptive, based on personal opinion. The reports in the second group contained a more reflective analysis of the MLS lessons; however, the literature review was rarely carried out, the research questions were frequently problematic, and the conclusions did not always correspond to the aims. The research reports of the third and fourth performance groups demonstrated a more sophisticated analysis of the MLS lessons, confirming the efficacy of the research-focused MLS. They generally attempted to apply research findings to solve specific problems, explain their own experiences from different perspectives, and draw thorough conclusions from the MLS process. The differences between these two groups were the quality of dialogic reflection, as the STs in the fourth group articulated precise research aims and questions and responded to them thoughtfully. At the same time, they also require further assistance with the literature review.

6.3. Student-teacher experience with research-focused microteaching lesson study

The deductive content analysis based on MLS characteristics and cycles (Fernández, 2010; Fernández & Robinson, 2006) revealed that STs who participated in the study reported the research-focused MLS helped them connect theory and practice and, to a lesser degree, contributed to developing their pedagogical content knowledge, collegial communication and cooperation, methodological knowledge, and research skills. This outcome corroborated studies (Bayrak Özmutlu, 2022; Fernández, 2010; Fernández & Robinson, 2006; Myers, 2012; Zhou et al., 2016; Álvarez et al., 2019) that also found that conducting LS, MLS, or integrating research-based TE principles into TE programs provided STs with opportunities to connect theory and practice, strengthen collaboration and reflection, and enable participants to become aware of the role of research and improved lessons in becoming teachers. Regarding MLS cycles, the majority of STs stressed that they perceived advancement in planning, implementing, and reflecting on MLS lessons but lesser developmental effects of revised MLS lessons. This may be related to the fact that the first three cycles were more related to teaching activities, while the last one involved research-oriented activities. Understanding their relevance was difficult for most STs participating in this study.

6.4. Limitations

This AR project aimed to develop and assess STs' research skills. Thus, the analyses were output-focused and limited to evaluating reflective research reports. Documents related to implementing research-focused MLS, such as lesson plans, research plans, reflective self-assessment, reflective formative peer feedback, assessment sheets, or surveys, were not examined. Triangulating data from these documents with the analysis of research reports would have offered greater insights into successful implementation. Although the system for evaluating the research reports was valid and reliable, only one researcher, the course instructor, assessed the reports. Involving a second evaluator and using the agreement level in the report analysis would have improved reliability.

Another limitation was the sample size, which primarily affected the division of the sample into groups; therefore, generalizations of the findings should be made with caution. Due to the limited sample size, the analysis did not examine background factors that might have influenced the quality of the research reports, such as the STs' writing skills, social skills, previous experience with teaching and research, perceptions of the course's effectiveness, and research attitudes. To assist participants in writing their research reports, they were provided with the evaluation scheme, guidelines, examples, and regular formative assessments, which may have influenced their reflections on the research-focused MLS.

7. Conclusions

This AR project examined the research skills development in third-year preservice TE students and the effectiveness of research-focused MLS. This study enriches MLS research with a new adaptation and verifies that MLS can effectively be implemented not only in methodological subjects but also in educational course settings to familiarize STs with research-based practice. Thus, research-focused MLS may be successfully applied in other research-based TE courses. The evaluation scheme developed in this study, which evaluated ST reports as well as helped STs present the outcomes and reflect on the teaching and research-focused activities, may also be useful in investigating the efficacy of future research-based MLS implementations.

This study found that through ST collaboration, research-focused MLS enhanced some research skills to varying extents. Analyzing MLS lessons was more successful than formulating research aims and questions or drawing conclusions; writing literature reviews caused the most difficulties. Because of the large individual differences identified in applying the research skills, the effects of research-focused MLS largely depended on the performance groups the STs belonged to. Analyzing STs' self-reported experiences with this MLS adaptation revealed that it aided the connection between theory and practice and contributed, although to a lesser extent, to the perceived development of pedagogical knowledge and collegial communication/cooperation.

The research-focused MLS offers some scope for the development of research skills; however, it is likely to be quite limited. A possible reason for this conclusion is that the present AR was conducted during one semester in a single course, but there is also a need to monitor how STs can apply the acquired knowledge in other courses, during their teaching practicum, and in preparing their portfolio and MEd thesis; thus, longitudinal studies can provide greater information on the effectiveness of research-based TE. More research is also needed to examine the effects of individual and environmental factors and explain the differences in research skills via triangulation using various qualitative and quantitative research and data analysis methods. Reducing the differences is one of the important tasks of TE. Achieving this requires that STs have additional practice opportunities and support to master research-based teaching practice.

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CRediT authorship contribution statement

Tibor Vigh: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

Declaration of competing interest

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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