

*International Journal of Learning, Teaching and Educational Research*  
 Vol. 25, No. 5, pp. 550-572, May 2026  
<https://doi.org/10.26803/ijlter.25.5.24>  
 Received Feb 17, 2026; Revised Apr 8, 2026; Accepted Apr 13, 2026

## The Impact of Microteaching Lesson Study on Pre-Service Teachers' Creative Teaching Competencies: Fluency, Flexibility, Originality, Elaboration and Sensitivity

Nurratri Kurnia Sari , Siswandari\* ,  
 Sajidan  and Sukarmin   
 Sebelas Maret University  
 Surakarta, Indonesia

**Abstract.** Teaching creativity is an essential competence for pre-service elementary teachers in 21st-century learning. However, conventional microteaching often places greater emphasis on procedural teaching skills than on the development of creativity. This highlights the need for reflective and collaborative models such as Microteaching Lesson Study (MLS) to foster innovation, flexibility, and responsiveness to students' needs systematically. To address this gap and introduce this approach into the context of teaching creativity in Indonesia, this study investigated the effect of integrating the MLS model and compared this with conventional microteaching. A quasi-experimental design was employed in this study. One limitation lay in the sampling procedure, as the number of participants and group composition were constrained by the pre-existing microteaching group structure established within the course. Consequently, fully randomized sampling was not possible, which may have limited the generalizability of the findings ( $n = 10$ ). The experimental group was taught using the MLS model over a 14-week period, while the comparison group received conventional microteaching instruction. Data were collected through pre- and post-teaching practice assessments and analyzed using mean, standard deviation, independent samples t-test, and paired samples t-test. The results revealed significant improvements across all creativity indicators based on the paired samples t-tests. Furthermore, the experimental group significantly outperformed the comparison group in terms of fluency (0.002), flexibility (0.004), originality (0.026), and sensitivity (0.009). Therefore, MLS proved to be effective in enhancing teaching creativity through systematic collaborative and reflective processes.

**Keywords:** Microteaching Lesson Study; teaching creativity; pre-service elementary teachers; quasi-experimental study; reflective learning

Citation:

Sari, N. K., Siswandari, S., Sajidan, S., & Sukarmin, S. (2026). The Impact of Microteaching Lesson Study on Pre-Service Teachers' Creative Teaching Competencies: Fluency, Flexibility, Originality, Elaboration and Sensitivity. *International Journal of Learning, Teaching and Educational Research*, 25(5), 550-572. <https://doi.org/10.26803/ijlter.25.5.24>

---

\*Corresponding author: *Nurratri Kurnia Sari*; [nurratrikurniasari@student.uns.ac.id](mailto:nurratrikurniasari@student.uns.ac.id)

## 1. Introduction

In the 21st century, education has to date undergone a substantial transformation that has been driven by rapid technological development, increasing complexity of learning environments, and diverse student needs (Butler-Ulrich et al., 2024). These changes require teachers not only to master subject matter and pedagogical knowledge but also to demonstrate high levels of creativity in designing and implementing meaningful learning experiences. Teaching creativity has therefore emerged as a critical professional competence, enabling teachers to adapt instructional strategies, employ innovative learning media, and respond flexibly to classroom dynamics (Kurniawati et al., 2024). For elementary education in particular, teaching creativity plays a foundational role, as early learning experiences significantly shape students' cognitive, social, and affective development.

The pedagogical landscape necessitates a continuous evolution in teacher preparation, particularly in fostering teaching creativity among pre-service educators. This is paramount because creative teachers are better equipped to navigate the complexities of contemporary classrooms and design engaging, effective learning experiences for their students (Chen et al., 2023). Moreover, the cultivation of creativity during pre-service training empowers future teachers to adapt to diverse educational contexts and implement innovative instructional strategies, which are crucial for addressing the dynamic needs of elementary school learners (Chen et al., 2023). Within teacher education programs, the development of teaching creativity is closely linked to microteaching courses, which are designed to provide pre-service teachers with opportunities to practice basic teaching skills in a controlled environment (Elias, 2018; Lee, 2017).

Conventional microteaching practices tend to emphasize technical performance and individual teaching proficiency rather than reflective learning processes. In many cases, microteaching is conducted as a one-time or a limited practice activity, followed by summative evaluation, with minimal opportunities for collaborative reflection, peer feedback, and iterative improvement. As a result, teaching creativity is often treated as an individual attribute rather than a professional competence that can be systematically developed through structured pedagogical intervention (Aizenkot & David, 2022; Hokanson & Kenny, 2020).

Previous studies on microteaching have reported positive effects on basic teaching skills, self-confidence, and classroom management abilities of pre-service teachers (Akkuş & Üner, 2017; Koşar, 2021). Similarly, lesson study has been widely recognized as an effective collaborative model for improving instructional quality through shared planning, observation, and reflection (Ayvacı & Özbek, 2024; Muñoz et al., 2023). Research on lesson study highlights its potential to foster reflective practice, pedagogical awareness, and professional learning communities among teachers (Anfara et al., 2009; Gutierrez, 2016).

This study posits that MLS model, an established methodology for refining pedagogical skills, offers a robust framework for developing this essential creativity among pre-service elementary teachers (Luo & Li, 2024). This approach

integrates the iterative reflection that is inherent in lesson study with the focused skill development offered by microteaching, creating a synergistic environment for pedagogical innovation (Mukuka & Alex, 2023; Sonsupap et al., 2025). This synthesis is expected not only to enhance the instructional creativity of pre-service teachers' but also to deepen their understanding of effective teaching practices through systematic observation, collaborative analysis, and the iterative refinement of lessons (Alamri & Alfayez, 2023; Kılıçkaya & Kic-Drgas, 2025). Such a structured approach supports the development of pedagogical content knowledge and equips future educators with the skills to use modern tools and procedures, including those facilitated by design thinking (Robbers et al., 2023).

Design thinking, characterized by its iterative and solution-based approach, has demonstrated considerable potential in improving pre-service teachers' abilities to craft interactive and student-centered teaching plans (Albay & Eisma, 2024; Ferrández et al., 2022). This methodology, often comprising stages such as empathizing, defining, ideation, prototyping, and testing, encourages a user-centered approach to instructional design, thereby fostering creative problem-solving and enhancing self-efficacy in teaching (Chen et al., 2023; Liu et al., 2023). Specifically, integrating design thinking into teacher education can equip pre-service teachers with the skills to design student-centered curricula and activities, moving beyond routine instruction to foster innovative classroom environments (Chen et al., 2023; Moran et al., 2023).

More importantly, there is a notable lack of evaluative research that examines the development of teaching creativity as a dynamic and measurable construct. Many previous studies assess creativity in general terms or rely on descriptive observation without employing systematic measurement across multiple stages of intervention (Cremin & Chappell, 2019; Li et al., 2024). This gap highlights the necessity for rigorous empirical studies that quantify the impact of specific pedagogical interventions, such as MLS, on distinct facets of teaching creativity over time (Greenier et al., 2023).

Furthermore, existing literature frequently emphasizes the importance of a maker mindset in education without adequately exploring structured pedagogical approaches that systematically cultivate this mindset among pre-service teachers (Li et al., 2024). Addressing this deficit, this study investigated how MLS, infused with design thinking principles, can systematically enhance the teaching creativity of pre-service elementary teachers' and cultivate a maker mindset, thereby bridging a critical gap in educational research (Chen et al., 2023; Li et al., 2024).

The novelty of this study lies in its exploration of the synergistic effects of MLS and design thinking in cultivating both teaching creativity and a maker mindset among pre-service elementary teachers, particularly through a quasi-experimental design that measures these constructs longitudinally. This approach acknowledges the intricate relationship between developing innovative instructional strategies and fostering an experimental, iterative mindset that is crucial for navigating complex educational challenges (Li et al., 2024). This

investigation specifically examines how the integration of design thinking with MLS can support pre-service teachers in developing the robust pedagogical practices and innovative questioning techniques that are essential for promoting students' maker mindsets (Li et al., 2025).

Accordingly, this study aimed to examine the effectiveness of MLS in enhancing teaching creativity among pre-service elementary school teachers. Specifically, the study investigated whether there are significant differences in teaching creativity across successive MLS interventions and identifies patterns of development across the five creativity indicators. By focusing on repeated measurements, this research sought to capture the trajectory of creative growth rather than isolated instructional outcomes. The significance of this study is twofold. First, it contributes to a deeper theoretical understanding of how structured pedagogical interventions foster teaching creativity and maker mindsets. Second, it offers practical insights for teacher education programs seeking to integrate innovative methodologies such as design thinking to prepare future educators for dynamic classroom environments (Chen et al., 2023; Liu et al., 2023). The primary objective of this study was to investigate the effect of the integration of MLS on the teaching creativity pre-service teachers at the university level, as reflected in the dimensions of flexibility, fluency, elaboration, originality, and sensitivity.

Hence, the following hypotheses were proposed:

Null Hypothesis ( $H_0$ ): There is no significant difference in teaching creativity, specifically flexibility, fluency, elaboration, originality, and sensitivity, among pre-service elementary teachers who receive microteaching through lesson study and those who receive microteaching alone.

Alternative Hypothesis ( $H_1$ ): There is a significant difference in teaching creativity, specifically flexibility, fluency, elaboration, originality, and sensitivity, among pre-service elementary teachers who receive microteaching through lesson study and those who receive microteaching alone.

## 2. Literature Review

To establish a coherent theoretical foundation, this section presents the key constructs underlying the study. It begins with a discussion of teaching creativity as a multidimensional pedagogical competence, followed by an overview of the MLS model as a reflective and collaborative approach in teacher education. Finally, the conceptual framework is outlined to clarify the relationship between MLS and the development of teaching creativity, including the specific dimensions that were examined in this study.

### 2.1 Teaching Creativity

Creativity can be understood as a multidimensional construct that extends beyond the production of novel and useful outcomes. It also involves cognitive, personal, social, and contextual processes that interact dynamically (Hernández-Torrano & Ibrayeva, 2020). Traditionally, creativity has been defined as the ability to generate ideas or products that are both novel and useful or effective. Conceptual frameworks such as the 4P model (person, process, product, and

press), originally proposed by Rhodes and later expanded into the 8P model by Sternberg & Karami, (2022), offer a more comprehensive perspective on creativity. These frameworks highlight that creativity encompasses individual characteristics, mental processes, environmental demands and supports, goals, types of problems, and the public acceptance of creative outcomes.

The definition of creativity as a form of internally directed attention constrained by generative goals, as proposed by Green et al., (2024), emphasizes that creativity occurs when individuals consciously direct their attention toward mental representations and manipulate them according to the goals they seek to achieve, particularly when these goals are generative and not yet fully available in memory. This process-oriented definition clarifies the distinction between creativity and other cognitive activities, such as simple recall or mind wandering, and provides a strong ontological foundation for examining creativity as a capacity that can be observed, trained, and developed, particularly in educational contexts.

Within the educational context, creativity is widely recognized as a key 21<sup>st</sup> century skills that is closely associated with critical thinking, communication, and collaboration, and is considered an essential prerequisite for individuals' readiness to navigate an increasingly complex and uncertain world (Byvalkevych et al., 2020). Therefore, as creativity has become a strategic goal in education, its practical development requires teachers to serve as key agents who can translate the value of creativity into instructional practice through teaching that is responsive to the challenges and demands of the 21st century.

The diversity of student characteristics, together with evolving curriculum demands, requires teachers not only to possess strong subject matter knowledge but also to design learning experiences that are innovative, adaptive, and meaningful (Farrugia, 2023). Conceptually, teaching creativity can be understood as a teacher's ability to generate, modify, and implement a range of ideas, strategies, media, and instructional approaches to achieve learning objectives in ways that are both effective and engaging. Teaching creativity involves not merely producing something new, but also ensuring that instructional practices are relevant, contextually appropriate, and capable of enhancing the quality of students' learning experiences (Calavia et al., 2023).

Teaching creativity is associated with the teacher's ability to think divergently, that is, to generate multiple alternative solutions or instructional strategies when responding to specific classroom situations. Some studies indicate that teaching creativity is a pedagogical capability reflected in the use of varied instructional methods, the ability to improvise, and the teacher's capacity to create learning environments that encourage exploration and active student engagement (Salinas et al., 2025; Sawyer, 2017). Teaching creativity is also considered a form of professional creativity, emerging from teachers' competencies, knowledge, experience, and reflective processes in planning and implementing instruction (Damanik & Widodo, 2024). More broadly, creativity is understood as the ability to solve problems in ways that are novel, innovative, original, and sometimes

unconventional, to develop unique and meaningful solutions (Groyecka et al., 2020; Santrock, 2018). As a complex human capacity, creativity is shaped by multiple factors, including social experiences, individual development, and educational processes, and these influence its expression across different domains (Olford, 1971). Within the teaching profession, teaching creativity constitutes an integral component of the pedagogical competence that supports instructional effectiveness (Oktavia, 2014). It is reflected in the use of instructional techniques that create engaging and enjoyable classroom environments and in the design of creative and meaningful learning experiences (Groyecka et al., 2020; Santrock, 2018). Based on these perspectives, teaching creativity can be defined as a teacher's ability to manage and facilitate the learning process effectively by integrating knowledge, dispositions, and social skills, ultimately contributing to improved student learning outcomes and enhanced instructional quality in the class.

## **2.2 Microteaching Lesson Study**

Microteaching Lesson Study is a professional development model for pre-service teachers that integrates microteaching practice with the collaborative and reflective principles of lesson study. This model is designed to provide systematic teaching and learning experiences, enabling pre-service teachers not only to practice technical teaching skills but also to develop reflective, collaborative, and creative thinking abilities (Lukitasari et al., 2021; Sukmawati & Purbaningrum, 2021). Through MLS, pre-service teachers are encouraged to connect pedagogical theory with classroom practice, experiment with various instructional strategies, and engage in continuous improvement based on feedback from instructors and peers. In this way, MLS plays an important role in fostering the pedagogical and professional competencies of pre-service teachers in a more meaningful and sustained manner (Dotger, 2011).

Microteaching Lesson Study has distinct characteristics compared to traditional microteaching. It engages pre-service teachers in collaborative learning processes aimed at developing shared understanding and the ability to design, implement, and reflect on instruction collaboratively (Danday, 2021). In contrast, traditional microteaching typically places pre-service teachers in individual teaching situations in which they deliver shortened lessons (approximately 5–20 minutes) to small groups of peers and subsequently receive feedback from peers and supervising instructors (Ramadhanti & Yanda, 2025). These experiences tend to be individual and to focus primarily on the mastery of distinct teaching skills, such as clarity of instruction or the effective use of wait time. Research findings on the effectiveness of traditional microteaching in improving teaching skills have also reported mixed results (Zulfikar et al., 2020).

In MLS implementation, the emphasis of microteaching shifts from merely developing isolated teaching skills to providing learning experiences that bridge theory and practice, while promoting collaboration and reflection among pre-service teachers. Pre-service teachers are encouraged to learn from one another through collaborative lesson planning and joint analysis of video recordings of each member's teaching practice (Molina, 2012). In this way, MLS not only

strengthens teaching skills but also fosters a reflective and collaborative culture within the pre-service teacher learning community.

In line with Kourieos, (2016), the use of video in learning has significant potential to provide more comprehensive feedback on the instructional practices of pre-service teachers. Within MLS, video recordings play a crucial role as a tool for groups to review, analyze, and reflect on the teaching practices of each member. In addition, these recordings are used by instructors as a basis for providing constructive feedback, enabling deeper reflection grounded in concrete evidence from actual teaching practice (Zhou et al., 2017). Fernández (2010) emphasizes the important role of an advisor in helping pre-service teachers examine their research lessons through a critical lens, which is essential to the lesson study process. In the context of MLS, a teacher educator or instructor can assume this role by observing and reviewing video recordings of MLS lessons in preparation for meeting with each group during lesson discussions. The differences in the design elements of MLS, microteaching, and lesson study are presented in Table 1.

**Table 1: Design elements of MLS, microteaching, and lesson study**

	<b>MLS</b>	<b>Microteaching</b>	<b>Lesson study</b>
<b>Lesson Content</b>	Comprehensive students' learning goals selected to support the development of pre-service teachers focus is on student learning in relation to authentic teaching practice.	Reducing the complexity of the content to be learned focus is on the teacher practicing specific teaching skills	Emphasis on students' comprehensive learning goals focus is on student learning in relation to real classroom teaching
<b>Structure of Experience</b>	Cycles of planning, implementation, analysis, and revision; collaboration within MLS groups.	Planning, teaching, and analysis, conducted individually	Cycles of planning, implementation, analysis, and revision with collaboration among lesson study groups
<b>Feedback</b>	Feedback from knowledgeable instructors or supervisors; peer feedback within MLS groups; video recordings used as evidence.	Feedback from mentors or instructors feedback from students or peers being taught (optional)	Feedback from knowledgeable external advisors feedback from peers and invited observers during lesson presentations Video recordings of lessons
<b>Implementation</b>	Reducing class size to facilitate group work (5-10 students or peer students).	Reducing class size (e.g., 5-10 students or peer students)	regular classroom settings
<b>Outcomes</b>	Written reflective reports and lesson plans to be shared.	No written report required	Written reflective reports that can be used by others.

### 2.3 Conceptual Framework of the Study

This study is grounded in several major learning theories that serve as the foundation for developing the conceptual framework of teaching creativity through the MLS model. First, constructivist learning theory, as reflected in the ideas of Ki Hajar Dewantara and further supported by contemporary constructivism, emphasizes that learners actively construct knowledge through experience and interaction.

This perspective underlines the importance of engaging pre-service teachers in authentic teaching practices that allow them to build pedagogical understanding through reflection and experience. Second, Lev Vygotsky's concept of the Zone of Proximal Development (ZPD) highlights the critical role of social interaction and collaboration in learning, suggesting that teaching competence, including creativity, develops through guided participation and peer interaction. Third, humanistic learning theory emphasizes the development of individual potential, self-awareness, and personal growth, which are essential for fostering creativity as a holistic and self-driven capacity.

Anchored in these theoretical perspectives, teaching creativity in this study is conceptualized as a multidimensional pedagogical competence involving cognitive, affective, and social dimensions. It encompasses the ability to generate diverse ideas (fluency), apply varied approaches (flexibility), produce novel instructional strategies (originality), and develop ideas in a detailed and structured manner (elaboration). In addition, sensitivity is considered as an important dimension, reflecting teachers' ability to identify learning problems, student needs, and classroom dynamics. These dimensions are consistent with creativity theories that view creativity not only as a product but also as a dynamic process shaped by interaction between individual abilities and environmental contexts.

The MLS model is designed as an instructional intervention that operationalizes these theoretical foundations into a structured learning process. It integrates collaborative learning (constructivism and ZPD), reflective practice (humanistic and experiential learning), and iterative improvement (professional learning theory) through four main stages: Plan, Do, See, and Replan. Each stage provides a specific space for the development of teaching creativity dimensions.

In the Plan stage, pre-service teachers collaboratively design learning activities, reflecting constructivist principles in which knowledge is co-constructed through discussion and shared experiences. At this stage, creativity emerges through fluency (generating multiple ideas), flexibility (developing alternative strategies), originality (designing novel approaches), elaboration (structuring detailed lesson plans), and sensitivity (identifying student needs and potential learning challenges).

In the Do stage, pre-service teachers implement their lesson plans in a microteaching setting. This stage reflects experiential learning and situational practice in which creativity is enacted in real-time. Flexibility becomes the

dominant dimension, as teachers must adapt to dynamic classroom conditions, followed by fluency and elaboration in responding spontaneously to student interactions, and sensitivity in recognizing students' responses and engagement. In the See stage, which represents the reflective core of lesson study, participants analyze teaching practices based on observations and video recordings. This stage is strongly grounded in reflective practice theory in which learning occurs through critical analysis of experience. Sensitivity becomes central, as teachers interpret classroom events and student behavior, while elaboration supports in-depth analysis and constructive feedback for improvement.

The integration of cognitive understanding, reflective activities, and the MLS syntax is expected to help pre-service teachers in developing creative and innovative thinking skills and the ability to create engaging and meaningful learning situations for students. Thus, MLS functions not only as a medium for practicing teaching skills but also as a means of shaping pre-service teachers into reflective, collaborative, and adaptive professionals who are prepared to meet the challenges of 21<sup>st</sup> century education. This model is supported by complementary resources, including lesson plans, MLS guidelines, and the MLS model handbook.

### **3. Methodology**

This quasi-experimental study employed a pre-test-post-test design with a control group to assess the impact of MLS on the teaching creativity and maker mindset of pre-service elementary teachers. This design allowed for a robust comparison between an intervention group participating in the MLS and a control group receiving traditional instruction, thereby enabling the isolation of the intervention's specific effects (Li et al., 2024). The intervention group consisted of 10 students who were prospective teachers and were consistently involved at each stage of the research, allowing researchers to observe changes in teaching creativity abilities on an ongoing basis over time.

#### **3.1 Setting**

The participants in this study comprised 20 first-year S1 students enrolled at Bangun Nusantara Veteran University in the 2023 academic year. They were selected using the cluster random sampling method. Broadly speaking, for the implementation of microteaching the participants were divided into 2 groups, each group consisting of 10 practical students. Similar research often involves dividing subjects into two main groups, namely the experimental group that received the intervention and the control group that did not receive the intervention, with each group ideally numbering 10 participants for the initial study or preliminary study (Emanuel et al., 2022). Nonetheless, larger sample sizes are often required to achieve adequate statistical power in identifying clinically or substantially significant effects of interventions.

Although the participants were taken from a single institution, the researchers believe that the findings can be generalized to universities in Indonesia due to the random student placement policy of the Ministry of Education. This system ensures a relatively uniform student population across the country covering a wide range of demographic and psychosocial variables. In addition, the study

targeted first-year undergraduate students who had only four months of university experience; therefore, the possibility of significant personal development that could affect the outcome was minimized. These factors support sample representation. The demographics regarding gender and age are presented in Table 2.

**Table 2: Participants' gender and age**

Demographic variable		Experimental group	Control Group
Gender	Male	3	2
	Female	7	8
Age	21-23 yrs	9	8
	> 23 yrs	1	2

### 3.2 Research Procedures

This research procedure was carried out in stages by integrating the MLS approach through the Plan-Do-See-Replan cycle. The research began with the pre-intervention stage, which is an initial measurement of the teaching creativity of prospective teachers based on five indicators of Guilford's creativity (fluency, flexibility, originality, elaboration, and sensitivity) as baseline data before the implementation of MLS (Sari et al., 2025; Wake et al., 2015). At this stage, students carry out initial microteaching with a conventional approach to obtain an overview of initial teaching abilities. This initial assessment serves as a crucial baseline for evaluating the subsequent impact of the MLS intervention on their pedagogical creativity and the cultivation of a maker mindset, allowing for a longitudinal analysis of their development (Saritepeci & Durak, 2024).

The experimental intervention spanned a period of six weeks, with four 30-minute sessions per week, during which pre-service teachers collaboratively investigated learning difficulties and prototyped educational solutions within a design thinking framework (Chen et al., 2023). This rigorous schedule facilitated an intensive and iterative process of pedagogical innovation, allowing for continuous refinement of instructional strategies and immediate feedback loops among the participants (Gao et al., 2025). Conversely, the control group engaged in conventional lesson planning and delivery without the structured collaboration and iterative refinement inherent in the MLS and design thinking model, ensuring a clear distinction between the experimental conditions (Wang et al., 2022).

### 3.3 Data Collection Instrument

Teaching creativity in this study was understood as the ability of prospective teachers to manage the learning process by integrating teaching skills innovatively, adaptively, and reflectively. Creativity was not positioned solely as the ability to produce unique ideas, but as a pedagogical capacity that appears in the planning, implementation, evaluation, and reflection of learning. Therefore, the instrument was designed to capture the manifestation of creativity in two main domains, namely the domain of planning and the domain of learning practice. Table 3 shows that the instrument refers to five indicators of thinking creativity that are adapted to the pedagogical context, namely fluency, flexibility, originality, elaboration, and sensitivity. The five indicators are translated operationally into model teacher performance indicators in microteaching

activities. The grids used for the teaching creativity assessment rubric can be seen in Table 3.

**Table 3: Blueprint of Teaching Creativity Assessment Instrument**

Aspect	Indicator	Lesson Plan	Teaching Practice
<b>Fluency</b>	Fluency and diversity of ideas in lesson planning	Objectives are clearly formulated	Questions are varied and continuous
		Learning materials are presented systematically and innovatively	Sustainable learning support
<b>Flexibility</b>	Ability to adapt the lesson plan to classroom context	Media are flexible for use in various situations	Quickly shifts strategies
		Uses adaptive teaching methods	Adaptive individual approach
<b>Originality</b>	Novelty of ideas in planning and instructional strategies	Creative and non-conventional media	Unique, creative, and engaging
		Innovative learning scenarios	Creative and meaningful
		–	Encourages new ideas
<b>Elaboration</b>	Depth and completeness in developing lesson plan components	Objectives are described in detail and operationally	Apperception, objectives delivery, and reflection
		Materials and worksheets (LKPD) are developed in depth	Integrated verbal and non-verbal reinforcement
		Assessment rubric is detailed and clear	Rich examples and illustrations

This assessment tool was developed to evaluate the degree of instructional creativity demonstrated by Elementary School Teacher Education students, encompassing both the lesson planning and the microteaching implementation phases. It arose from the need for an evaluation instrument that assesses not only fundamental pedagogical competencies but also the dimensions of pedagogical creativity inherent in the teaching process. This integrated approach ensures thorough documentation of both the theoretical foundations and practical execution of innovative instructional strategies.

Creativity assessment in the MLS model consists of two assessment components, namely 1) Learning Preparation Score (N1 = 40%) and 2) Learning Practice Score (N2 = 60%). The learning preparation score is the result of the assessment of the preparation of the Learning Implementation Plan. Students must prepare RPPs or teaching modules as many as the teaching practices carried out. The learning score is derived from direct observation of the teaching practices, often employing rubrics that evaluate various aspects of creative pedagogical approaches and student engagement (Ayu et al., 2023). This observation typically incorporates structured instruments such as observation sheets that are designed to evaluate student and lecturer activities during practical sessions, ensuring a

comprehensive assessment of the creative learning environment (Rizal et al., 2024). Such instruments use a Likert scale for systematic quantification of observed behaviors and characteristics, alongside open-ended questions to gather qualitative insights and expert feedback on the design and effectiveness of creative instructional strategies (Greenier et al., 2023; Nurrijal et al., 2023). The integration of both quantitative and qualitative measures ensures a robust evaluation of teaching creativity, aligning with frameworks that consider multiple dimensions of creative pedagogy (Greenier et al., 2023).

## 4. Results and Findings

### 4.1 Results Before the intervention

Before the intervention, data were collected from the study participants applying the cognitive understanding stage. At this stage, the research participants carried out the practice of seven teaching skills. Teaching creativity data were observed based on the assessment rubric developed in the creativity table 1. An analysis of early teaching creativity used an independent sample t-test to check whether the writing status of the two groups was comparable (Table 4).

**Table 4: Pre-test comparison of teaching creativity between groups**

Teaching creativity	Experimental group			Comparison group			T	df	Sig
	N	M	SD	N	M	SD			
Fluency	10	77.5	4.08	10	76.25	5.17	-0.600	18	0.556
Elaboration	10	72.99	3.02	10	74.50	4.45	0.883	18	0.389
Flexibility	10	73.25	4.87	10	75.75	3.92	1.265	18	0.222
Original	10	75.5	4.97	10	74.75	3.42	-0.393	18	0.699
Sensitivity	10	76.25	6.79	10	75.58	4.68	-0.256	18	0.801

### 4.2 Pre-test Comparison of Writing Skills Between Groups

Based on the results of the independent sample t-test at the pre-test stage (Table 4), it was shown that there was no significant difference between the experimental group and the comparison group in all aspects of teaching creativity. In terms of fluency, the average of the experimental group ( $M = 77.5$ ;  $SD = 4.08$ ) was slightly higher than the comparison group ( $M = 76.25$ ;  $SD = 5.17$ ), but the difference was not significant ( $t = -0.600$ ;  $sig = 0.556$ ). In the elaboration aspect, the comparison group had a higher average ( $M = 74.50$ ;  $SD = 4.45$ ) than the experimental group ( $M = 72.99$ ;  $SD = 3.02$ ), with a significance value of  $0.389 (>0.05)$ .

Similarly, in terms of flexibility ( $t = 1.265$ ;  $sig = 0.222$ ), originality ( $t = -0.393$ ;  $sig = 0.699$ ), and sensitivity ( $t = -0.256$ ;  $sig = 0.801$ ), the overall significance value was above  $0.05$ . These results show that the initial ability of teaching creativity of the two groups is in a comparable (homogeneous) condition, making it feasible to proceed to the intervention stage without any significant difference in the initial condition.

### 4.3 Results After the Intervention

At the end of the intervention, data were collected from the study participants through observations on the teaching creativity assessment rubric and analyzed using mean, standard deviation, independent sample t-test, and paired sample t-test.

**Table 5: Post-test comparison of teaching creativity between group**

Teaching creativity	Experimental group			Comparison group			df	sig	
	N	M	SD	N	M	SD			
Fluency	10	91.67	5.14	10	83.00	5.75	-3.555	18	0.002
Elaboration	10	86.33	6.74	10	80.75	7.27	-1.781	18	0.092
Flexibility	10	88.75	6.15	10	81.25	3.58	-3.331	18	0.004
Original	10	84.75	6.21	10	79.09	3.97	-2.430	18	0.026
Sensitivity	10	85.75	3.99	10	80.99	3.23	-2.922	18	0.009

Based on the results of the post-test (Table 5), there was an increase in teaching creativity in both groups, but the experimental group showed higher achievement than the comparison group in almost all aspects. In terms of fluency, the average of the experimental group ( $M = 91.67$ ;  $SD = 5.14$ ) was significantly higher than that of the comparison group ( $M = 83.00$ ;  $SD = 5.75$ ) with a significance value of 0.002 ( $<0.05$ ). The same is true in the aspects of flexibility ( $M = 88.75$  vs  $81.25$ ;  $sig = 0.004$ ), originality ( $M = 84.75$  vs  $79.09$ ;  $sig = 0.026$ ), and sensitivity ( $M = 85.75$  vs  $80.99$ ;  $sig = 0.009$ ), all of which show significant differences between groups.

Meanwhile, in the elaboration aspect, although the average of the experimental group ( $M = 86.33$ ;  $SD = 6.74$ ) was higher than the comparison group ( $M = 80.75$ ;  $SD = 7.27$ ), the difference was not statistically significant ( $sig = 0.092 > 0.05$ ). Overall, these results show that interventions have a positive influence on increasing teaching creativity, especially in the aspects of fluency, flexibility, originality, and sensitivity.

#### 4.4 Pre-test and Post-Test Comparison of the Experimental Group

Based on the results of the paired sample t-test in the experimental group (Table 6), there was a significant improvement in all aspects of teaching creativity between the pre-test and the post-test. For the fluency aspect, the average increased from 77.5 ( $SD = 4.08$ ) to 91.67 ( $SD = 5.14$ ) with a significance value of 0.000 ( $<0.05$ ). A significant increase also occurred in the elaboration aspect from 72.99 ( $SD = 3.02$ ) to 86.33 ( $SD = 6.74$ ) with a sig of 0.000. The flexibility aspect increased from 73.25 to 88.75 ( $sig = 0.001$ ), the originality aspect from 75.5 to 84.75 ( $sig = 0.004$ ), and the sensitivity aspect from 76.25 to 85.75 ( $sig = 0.003$ ). The overall significance value was below 0.05, which suggests that the intervention given to the experimental group effectively increased teaching creativity for all the indicators that were measured.

**Table 6: Pre-test and post-test comparison of the experimental group**

Teaching creativity	Pretest			Postes			t	df	sig
	N	M	SD	N	M	SD			
Fluency	10	77.5	4.08	10	91.67	5.14	-6.755	9	0.000
Elaboration	10	72.99	3.02	10	86.33	6.74	-6.048	9	0.000
Flexibility	10	73.25	4.87	10	88.75	6.15	-4.875	9	0.001
Original	10	75.5	4.97	10	84.75	6.21	-3.889	9	0.004
Sensitivity	10	76.25	6.79	10	85.75	3.99	-4.001	9	0.003

Students' learning experiences using the MLS model were analyzed using descriptive statistics. Students' responses to the implementation of the MLS model are presented in Table 7.

**Table 7: Percentage of student responses to MLS model**

No.	Statement	Strongly Agree	Agree	Strongly Disagree	Disagree
1	MLS models helped me generate a lot of learning ideas	64.52	35.48	-	-
2	MLS has made me more flexible in choosing teaching methods	54.84	29.03	16.13	-
3	Collaborative discussions in MLS enrich teaching viewpoints	74.19	25.81	-	-
4	The level of reflection (See) helps me improve my learning strategy	87.10	12.90	-	-
5	MLS encouraged me to dare to try a variety of methods and media	74.19	16.13	9.68	-
6	Peer feedback helps develop teaching creativity	77.42	19.35	3.23	-
7	MLS makes microteaching learning more meaningful	70.97	29.03	-	-
8	I feel comfortable experimenting in learning through MLS	93.55	6.45	-	-
9	MLS helps me tailor learning to the needs of students	93.55	6.45	-	-

Table 7 shows that prospective elementary school teachers (n=10) answered yes and strongly agreed to implement the MLS model when providing their learning experience. However, some students expressed disapproval or demonstrated negative responses to flexible points, prompting prospective teachers to try variations and feedback from the supervisor. These findings show that prospective elementary school teachers had positive experiences when implementing the MLS model.

## 5. Discussion

The present study employed a quasi-experimental design to investigate the effect of the MLS model on enhancing teaching creativity among pre-service elementary teachers. As presented in Table 5, the post-test results indicate that the use of the MLS model produced significantly higher scores than conventional microteaching in the aspects of fluency, flexibility, originality, and sensitivity, while the elaboration aspect showed improvement but did not reach significance between the groups. Furthermore, the results of the paired sample t-test for the experimental group revealed significant improvements across all aspects of teaching creativity from the pre-test to the post-test.

These findings are consistent with the theoretical foundation of lesson study as a collaborative and reflective model of professional development. Through the cyclical stages of planning (Plan), teaching (Do), reflecting (See), and Replanning pre-service teachers engaged in a systematic analysis of their instructional practices (Cheng, 2024; Sonsupap et al., 2025). Reflective discussions and peer feedback sessions created opportunities to examine lesson design, classroom interactions, and student engagement critically (Hartmann et al., 2025). This iterative and collaborative process encouraged participants to experiment with new ideas, reconsider their pedagogical decisions, and continuously refine their

teaching practices, which are the key conditions for the development of creativity in teaching.

Overall, this study demonstrates that enhancing teaching creativity among pre-service elementary teachers through the MLS model is both feasible and effective (Cheng, 2024; Sari et al., 2025). Beyond improving quantitative creativity scores, MLS also promotes reflective thinking, collaborative learning, and pedagogical innovation. Therefore, integrating MLS into teacher education programs, particularly microteaching courses, is strongly recommended as a strategic approach to preparing future teachers who are not only technically competent but also creative, adaptive, and responsive to diverse classroom contexts (Konečná et al., 2023; Sari et al., 2025).

During the intervention stage, a significant improvement was observed across all aspects of teaching creativity within the MLS model (See Table 6). Creativity is a skill that can be developed through continuous practice (Torres Gomez et al., 2021) and includes five key indicators: fluency, flexibility, originality, elaboration, and sensitivity. These five aspects serve as an important framework for examining how teaching creativity can be demonstrated in actual classroom practice (Alabbasi et al., 2022; Handayani et al., 2021).

Fluency is reflected in the ability of pre-service teachers to generate various pedagogical alternatives smoothly, for example using different ways to begin a lesson, formulating tiered questions, and explaining concepts through multiple examples or analogies without significant difficulties. Meanwhile, flexibility is evident when pre-service teachers can adjust their strategies, methods, and forms of reinforcement based on classroom dynamics and students' responses, for example, changing a discussion into a structured question-and-answer session or modifying instructional media when students appear passive. Originality emerges through the use of unique and meaningful instructional strategies, media, or approaches within the classroom context, such as designing creative teaching aids, initiating lessons with cognitive conflict, or using unusual metaphors to clarify concepts (Henriksen et al., 2020; Lin, 2011).

Through the MLS process, the three indicators of fluency, flexibility, and originality develop as pre-service teachers practice teaching, observe their peers' instructional practices, and revise their strategies based on collective reflection. Meanwhile, elaboration and sensitivity contribute to deepening the pedagogical quality of teaching creativity. Elaboration is reflected in the ability of pre-service teachers to expand their ideas through clear and structured explanations, contextual examples, follow-up questions, and informative feedback that helps students understand the reasoning behind correct answers (Asregid et al., 2023). Sensitivity represents an affective and cognitive foundation that enables teachers to recognize students' needs, difficulties, and responses quickly, whether in classroom management, facilitating discussions, or guiding various learning activities. The MLS model principally strengthens these two indicators through observations that focus on student behavior and video-based reflection. Through

this process, pre-service teachers not only evaluate their own performances but also learn to understand students' learning processes better (Tamsah et al., 2023).

The greatest improvement in the average teaching creativity score intervention group was observed in the fluency indicator ( $M = 91.67$ ). The MLS model systematically creates a safe and iterative space for pre-service teachers to generate a wide range of instructional ideas (Papadakis, 2021). During the Plan stage, pre-service teachers are not limited to designing a single lesson scenario; instead, they are encouraged to propose multiple alternative strategies, methods, media, and classroom management approaches through collaborative discussions. This process facilitates the generation of ideas in quantity, which is the essence of fluency. In contrast to conventional microteaching in which pre-service teachers tend to focus on producing one best design, MLS emphasizes exploring various possibilities before making instructional decisions.

As a result, the ability to generate multiple ideas within a relatively short time is honed naturally. The strength of fluency is further reinforced during the Do stage in which students implement their lesson plans in small-scale, low-risk microteaching situations. This environment allows them to experiment with spontaneous responses to classroom dynamics without excessive evaluative pressure (Fauziyah, 2021). When a particular strategy does not work effectively, teachers are encouraged to generate alternative ideas immediately such as varying their questioning techniques, modifying explanatory approaches, or adjusting learning activities. This practice directly trains pedagogical fluency, allowing it to emerge not only during the planning phase but also in the actual teaching practice (Budnyk et al., 2021).

Meanwhile, flexibility emerged as the most prominent indicator because the MLS process requires pre-service teachers to shift consciously from one perspective to another (Arán Filippetti & Krumm, 2020). During the See stage, which involves observation and reflection, the teachers evaluate the lesson not only from the perspective of the instructors but also from that of the observers, their peers, and even their students. This process encourages them to analyze a single learning event through multiple analytical lenses.

The ability to shift perspectives in this way represents the core of flexibility (Fonagy & Luyten, 2019). Flexibility also develops because MLS emphasizes evidence-based reflection. The pre-service teachers are presented with concrete data, such as video recordings, observation notes, and collective feedback. When the evidence indicates that a particular strategy is less effective, they are encouraged to move beyond their initial preferences and consider alternative approaches. This process fosters adaptive ability and readiness to modify instructional strategies, which are key characteristics of pedagogical flexibility.

Social interaction within the MLS process also plays an important role in strengthening the dominance of flexibility and fluency. Collaborative discussions enable intensive exchanges of ideas among pre-service teachers. When one proposes an idea, others respond to it, modify it, or develop it in different

directions. This process not only increases the number of ideas that are generated (fluency) but also broadens the range of idea categories (flexibility). Through this experience, pre-service teachers learn that a single learning objective can be achieved through multiple pedagogical pathways, preventing them from becoming confined to a rigid pattern of thinking (Idawati et al., 2020).

Small-scale and controlled microteaching environments provide abundant opportunities for experimentation (Iliasova et al., 2025). Pre-service teachers tend to feel more confident in trying new approaches because the consequences of failure are relatively low. This sense of safety is an important prerequisite for the development of fluency and flexibility (Tira et al., 2022). In real classroom situations, which are often more complex, novice teachers tend to be cautious and avoid variation. However, through the MLS process, they are encouraged to view variation and change as integral parts of professional growth rather than threats.

The dominance of fluency and flexibility in the MLS model can also be understood from the perspective of the professional development of pre-service teachers. During the early stages developing teaching competence, the ability to generate multiple ideas and adapt instructional strategies is often more fundamental than producing highly original ideas or engaging in deeply elaborated teaching practices. Originality and elaboration generally develop as teachers gain more extensive teaching experience. Therefore, MLS realistically accommodates the developmental needs of pre-service teachers, which helps to explain why fluency and flexibility tend to emerge more strongly.

The MLS model represents a synergy of cyclical design, reflective practice, collaborative interaction, and a learning environment that is safe for experimentation. It not only trains pre-service teachers to generate a wide range of ideas but also encourages them to think flexibly in responding to dynamic learning situations. These two indicators form an essential foundation for sustainable teaching creativity, as creative teachers are not only capable of generating new ideas but are also able to adapt and develop those ideas in response to the evolving needs of different learning contexts.

## **6. Conclusion**

Based on the results and discussion, it can be concluded that the implementation of the MLS model significantly improves the teaching creativity of pre-service elementary teachers. The results of the independent samples t-test at the pre-test stage indicated that both groups were in comparable initial conditions. Therefore, the improvements observed in the post-test can be attributed to the effectiveness of the intervention.

After the implementation of MLS, the experimental group showed significantly greater improvement than the comparison group in the aspects of fluency, flexibility, originality, and sensitivity, with significant improvements also being observed across all indicators based on the paired samples t-test. Although the elaboration aspect did not show a statistically significant difference between the groups, the mean score still demonstrated a meaningful increase. Overall, MLS

has proved to be an effective collaborative and reflective approach for developing the cognitive, affective, and pedagogical dimensions of teaching creativity through the systematic Plan-Do-See-Replan cycle.

The implications of this study are both theoretical and practical. Theoretically, the findings reinforce the view that teaching creativity is a competency that can be developed through continuous practice, reflective processes, and collaborative interaction within a safe and structured learning environment. The MLS model provides a pedagogical framework that enables pre-service teachers to generate multiple instructional strategies (fluency), adapt their approaches to classroom dynamics (flexibility), introduce meaningful and unique learning ideas (originality), deepen explanations and instructional reinforcement (elaboration), and respond sensitively to students' needs (sensitivity).

Practically, the findings of this study recommend integrating the MLS model into microteaching courses in teacher education programs as a systematic strategy to foster teaching creativity during the pre-service stage. Teacher education institutions can develop learning designs that incorporate video-based reflection, collaborative discussions, and peer feedback as integral components of the curriculum. In this way, MLS not only improves creativity scores quantitatively but also helps shape future teachers who are adaptive, reflective, and innovative in addressing the complexities of real classroom learning environments.

### Conflicts of Interest

The authors have no conflicts of interest to disclose.

## 7. Acknowledgments

The authors wish to acknowledge the use of [name/s of AI Tool/s] in the writing of this paper. This tool was used to help improve the language and grammar in the paper. The paper remains an accurate representation of the author's work and intellectual contributions.

## 8. References

- Aizenkot, D., & David, Y. B. (2022). An exploratory study of 21st century skills of undergraduate education students: A comparison between freshman, second, and graduation years. *Innovations in Education and Teaching International*, 60(4), 524–533. <https://doi.org/10.1080/14703297.2022.2052931>
- Akkuş, H., & Üner, S. (2017). The effect of microteaching on pre-service chemistry teachers' teaching experiences. *Cukurova University Faculty of Education Journal*, 46(1), 202. <https://doi.org/10.14812/cuefd.309459>
- Alabbasi, A. M. A., Paek, S. H., Kim, D., & Cramond, B. (2022). What do educators need to know about the Torrance tests of creative thinking: A comprehensive review. *Frontiers Psychology*, 13, 1000385. <https://doi.org/10.3389/fpsyg.2022.1000385>
- Alamri, H., & Alfayez, A. A. (2023). Preservice teachers' experiences of observing their teaching competencies via self-recorded videos in a personalized learning environment. *Humanities and Social Sciences Communications*, 10(1), Article 745. <https://doi.org/10.1057/s41599-023-02260-2>
- Albay, E. M., & Eisma, D. V. (2024). Using design thinking for developing pre-service teachers' creativity in designing teaching plans to promote interactive learning in

- mathematics. *Learning and Instruction*, 96, 102070. <https://doi.org/10.1016/j.learninstruc.2024.102070>
- Anfara, V. A., Lenski, S., & Caskey, M. M. (2009). Using the lesson study approach to plan for student learning. *Middle School Journal*, 40(3), 50–57. <https://doi.org/10.1080/00940771.2009.11495587>
- Aoonlamai, N., & Kwangmuang, P. (2025). Integrating digital tools and constructivist learning: A ubiquitous learning framework for enhancing creativity in music education. *BMC Psychology*, 13, 1064. <https://doi.org/10.1186/s40359-025-03300-z>
- Asregid, D., Mihiretie, D. M., & Kassa, S. A. (2023). Teacher educators use of feedback to facilitate reflective practice among pre-service teachers during microteaching. *Cogent Education*, 10(2), Article 2257121. <https://doi.org/10.1080/2331186X.2023.2257121>
- Ayu, H. D., Saputro, S., Sarwanto, S., & Mulyani, S. (2023). Reshaping technology-based projects and their exploration of creativity. *Eurasia Journal of Mathematics, Science and Technology Education*, 19(1), Article 2217. <https://doi.org/10.29333/ejmste/12814>
- Ayvaci, H. Ş., & Özbek, D. (2024). Addressing challenges: Lesson study method in teaching practice course. *İstanbul Aydın Üniversitesi Eğitim Fakültesi Dergisi*, 10(1), 69–98. <https://izlik.org/JA24EM88LM>
- Budnyk, O., Mazur, P., Matsuk, L., Berezovska, L., & Vovk, O. (2021). Development of professional creativity of future teachers (Based on comparative research in Ukraine and Poland). *Revista Amazonia Investiga*, 10(44), 9–17. <https://doi.org/10.34069/ai/2021.44.08.1>
- Butler-Ulrich, T., Hughes, J., & Morrison, L. (2024). Creativity and generative AI for preservice teachers. In L. Barlach (Ed.), *Contemporaneous issues about creativity*. <https://doi.org/10.5772/intechopen.1007517>
- Byvalkevych, L., Yefremova, O., & Hryshchenko, S. (2020). Developing technical creativity in future engineering educators. *Revista Romaneasca Pentru Educatie Multidimensionala*, 12(1), 162–175. <https://doi.org/10.18662/rrem/206>
- Calavia, M. B., Blanco, T., Casas, R., & Dieste, B. (2023). Making design thinking for education sustainable: Training preservice teachers to address practice challenges. *Thinking Skills and Creativity*, 47, 101199. <https://doi.org/10.1016/j.tsc.2022.101199>
- Chen, K., Chen, J., & Wang, C. (2023). The effects of two empathy strategies in design thinking on pre-service teachers' creativity. *Knowledge Management & E-Learning*, 15(3), 468–468. <https://doi.org/10.34105/j.kmel.2023.15.027>
- Cheng, E. C. K. (2024). Exploring pedagogical design in lesson study through the SECI model: A case study of preservice teacher learning metacognitive pedagogies. *Asia-Pacific Journal of Educational Management Research*, 9(2), 17–32. <https://doi.org/10.21742/ajemr.2024.9.2.02>
- Cremin, T., & Chappell, K. (2019). Creative pedagogies: A systematic review. *Research Papers in Education*, 36(3), 299–331. <https://doi.org/10.1080/02671522.2019.1677757>
- Damanik, J., & Widodo, W. (2024). Unlocking teacher professional performance: Exploring teaching creativity in transmitting digital literacy, grit, and instructional quality. *Education Sciences*, 14(4), 384. <https://doi.org/10.3390/educsci14040384>
- Danday, B. A. (2021). Advancing preservice physics teachers' critical thinking through active and passive microteaching lesson study. *International Journal of Learning, Teaching and Educational Research*, 20(3), 205–228. <https://doi.org/10.26803/ijlter.20.3.13>

- Dotger, S. (2011). Exploring and developing graduate teaching assistants' pedagogies via lesson study. *Teaching in Higher Education*, 16(2), 157–169. <https://doi.org/10.1080/13562517.2010.507304>
- Elias, S. K. (2018). Pre-service teachers' approaches to the effectiveness of micro-teaching in teaching practice programs. *Open Journal of Social Sciences*, 6(5), 205–224. <https://doi.org/10.4236/jss.2018.65016>
- Farrugia, R. (2022). *Fostering creativity through design and technology education* [Master's dissertation, University of Malta]. <https://www.um.edu.mt/library/oar/handle/123456789/137309>
- Fauziyah, Z. (2021). *Analisis technological pedagogical and content knowledge (TPACK) Guru Kelas VI di MIN 6 Sukoharjo* [Doctoral dissertation, Universitas Muhammadiyah Surakarta].
- Fernández, M. L. (2010). Investigating how and what prospective teachers learn through microteaching lesson study. *Teaching and Teacher Education*, 26(2), 351–362. <https://doi.org/10.1016/j.tate.2009.09.012>
- Ferrández, M., Blanco, T., Casas, R., & Gracia, B. D. (2022). Making design thinking for education sustainable: Training preservice teachers to address practice challenges. *Thinking Skills and Creativity*, 47, 101199. <https://doi.org/10.1016/j.tsc.2022.101199>
- Filippetti, V. A., & Krumm, G. (2020). A hierarchical model of cognitive flexibility in children: Extending the relationship between flexibility, creativity and academic achievement. *Child Neuropsychology*, 26(6), 770–800. <https://doi.org/10.1080/09297049.2019.1711034>
- Fonagy, P., & Luyten, P. (2019). Fidelity vs. flexibility in the implementation of psychotherapies: Time to move on. *World Psychiatry*, 18(3), 270–271. <https://doi.org/10.1002/wps.20657>
- Gao, Y., Gan, L., Zhang, X., & Zhang, D. X. (2025). Knowledge-building activities foster reflective mindsets in EFL pre-service teachers: Enhancing creative teaching practices. *Humanities and Social Sciences Communications*, 12(1), Article 1535. <https://doi.org/10.1057/s41599-025-05818-4>
- Green, A. E., Beaty, R. E., Kenett, Y. N., & Kaufman, J. C. (2024). The process definition of creativity. *Creativity Research Journal*, 36(3), 544–572. <https://doi.org/10.1080/10400419.2023.2254573>
- Greenier, V., Fathi, J., & Behzadpoor, S.-F. (2023). Teaching for creativity in an EFL context: The predictive roles of school climate, teaching enthusiasm, and metacognition. *Thinking Skills and Creativity*, 50, 101419. <https://doi.org/10.1016/j.tsc.2023.101419>
- Groyecka, A., Gajda, A., Jankowska, D. M., Sorokowski, P., & Karwowski, K. (2020). On the benefits of thinking creatively: Why does creativity training strengthen intercultural sensitivity among children. *Thinking Skills and Creativity*, 37, 100693. <https://doi.org/10.1016/j.tsc.2020.100693>
- Gutierrez, S. B. (2016). Teachers' reflective practice in lesson study: A tool for improving instructional practice. *Alberta Journal of Educational Research*, 61(3), 314–328. <https://doi.org/10.55016/ojs/ajer.v61i3.56087>
- Handayani, S. A., Rahayu, Y. S., & Agustini, R. (2021). Students' creative thinking skills in biology learning: Fluency, flexibility, originality, and elaboration. *Journal of Physics: Conference Series*, 1747(1), 012040. <https://doi.org/10.1088/1742-6596/1747/1/012040>
- Hartmann, U., Kindlinger, M., Trempler, K., Molitor, A., & Fives, H. (2025). Reflecting on teaching together and alone: Preservice teachers' processes of knowledge construction in writing and discussion. *Frontiers in Education*, 10. <https://doi.org/10.3389/educ.2025.1668962>

- Henriksen, D., Richardson, C., & Shack, K. (2020). Mindfulness and creativity: Implications for thinking and learning. *Thinking Skills and Creativity*, 37, 100689. <https://doi.org/10.1016/j.tsc.2020.100689>
- Hernández-Torrano, D., & Ibrayeva, L. (2020). Creativity and education: A bibliometric mapping of the research literature (1975–2019). *Thinking Skills and Creativity*, 35, 100625. <https://doi.org/10.1016/j.tsc.2019.100625>
- Hokanson, B., & Kenny, R. (2020). Creativity and critique as formative processes in design thinking. *Journal of Formative Design in Learning*, 4(1), 2–4. <https://doi.org/10.1007/s41686-020-00047-1>
- İdawati, İ., Setyosari, P., Kuswandi, D., & Ulfa, S. (2020). Investigating the effects of problem-solving method and cognitive flexibility on improving university students' metacognitive skills. *Journal for the Education of Gifted Young Scientists*, 8(2), 651–665. <https://doi.org/10.17478/jegys.652212>
- Iliasova, L., Nekrasova, I., Mena, J., & Estrada-Molina, O. (2025). Microteaching on pre-service teachers' education: Literature review. *Frontiers in Education*, 10, 1562975. <https://doi.org/10.3389/feduc.2025.1562975>
- Kılıçkaya, F., & Kic-Drgas, J. (2025). Pre-service language teachers' experiences and perceptions of integrating generative AI in practicum-based lesson study. *Humanities and Social Sciences Communications*, 12(1), Article 1478. <https://doi.org/10.1057/s41599-025-05715-w>
- Konečná, P., Smolka, P., Trčková, K., Václavíková, Z., & Žáček, M. (2023). Innovation of pedagogical practices of future teachers. *Education Sciences*, 13(4), 355. <https://doi.org/10.3390/educsci13040355>
- Koşar, G. (2021). Microteaching: A technique to enhance English-as-a-foreign language teacher candidates' professional learning. *İnönü Üniversitesi Eğitim Fakültesi Dergisi*, 22(1), 628–651. <https://doi.org/10.17679/inuefd.804714>
- Kourieos, S. (2016). Video-mediated microteaching-A stimulus for reflection and teacher growth. *Australian Journal of Teacher Education*, 41(1), 65–80. <https://doi.org/10.14221/ajte.2016v41n1.4>
- Kurniawati, A., Nurhayati, S., & Rukanda, N. (2024). Enhancing early childhood education teachers' creativity through professional development training programs. *Aulad: Journal on Early Childhood*, 7(1), 141–149. <https://doi.org/10.31004/aulad.v7i1.537>
- Lee, K.-H. (2017). Convergent and divergent thinking in task modification: A case of Korean prospective mathematics teachers' exploration. *ZDM Mathematics Education*, 49(7), 995–1008. <https://doi.org/10.1007/s11858-017-0889-x>
- Lendínez Muñoz, E. M., García, F. J. G., Lerma, A. M., & Gallego, A. M. A. (2023). Increase in self-efficacy in prospective teachers through theory-based lesson study. *Journal of Mathematics Teacher Education*, 27(4), 717–742. <https://doi.org/10.1007/s10857-023-09597-0>
- Li, G., Chu, R., & Tang, T. (2024). Creativity self-assessments in design education: A systematic review. *Thinking Skills and Creativity*, 52, 101494. <https://doi.org/10.1016/j.tsc.2024.101494>
- Li, J., Goei, S., & Huang, R. (2024). Unveiling maker mindsets: A journey of formation and transformation through design thinking-making pedagogy within a lesson study context. *Frontiers in Education*, 9, 1343492. <https://doi.org/10.3389/feduc.2024.1343492>
- Li, J., Goei, S. L., Van Joolingen, W., & Raijmakers, M. E. J. (2025). Shaping maker education through design thinking: A lesson study perspective. *Thinking Skills and Creativity*, 59, 101957. <https://doi.org/10.1016/j.tsc.2025.101957>
- Lin, Y.-S. (2011). Fostering creativity through education – A conceptual framework of creative pedagogy. *Creative Education*, 2(3), 149–155. <https://doi.org/10.4236/ce.2011.23021>

- Liu, X., Gu, J., & Xu, J. (2023). The impact of the design thinking model on pre-service teachers' creativity, self-efficacy, inventive problem-solving skills, and technology-related motivation. *International Journal of Technology and Design Education*, 34(1), 167–190. <https://doi.org/10.1007/s10798-023-09809-x>
- Lukitasari, M., Hasan, R., & Murtafiah, W. (2021). Microteaching lesson study of biology prospective teacher to develop lesson plan design and teaching ability. *Jurnal Pendidikan Indonesia*, 10(3), 590–600. <https://doi.org/10.23887/jpi-undiksha.v10i3.22701>
- Luo, Z., & Li, H. (2024). Competence, preparation, and relaxation: Contributing factors to EFL student teachers' self-efficacy and teaching performance in microteaching training. *Heliyon*, 10(4). <https://doi.org/10.1016/j.heliyon.2024.e26216>
- Molina, R. V. (2012). *Microteaching lesson study: Mentor interaction structure and its relation to elementary preservice mathematics teacher knowledge development* [Doctoral dissertation, Florida International University]. ProQuest LLC. <https://doi.org/10.25148/etd.FI12050222>
- Moran, R., Robertson, L., Tai, C.-C., Ward, N. A., & Price, J. (2023). Developing pre-service teachers' adaptive expertise through STEM-CT integration in professional development and residency placements. *Frontiers in Education*, 8, 1267459. <https://doi.org/10.3389/feduc.2023.1267459>
- Mukuka, A., & Alex, J. K. (2023). Review of research on microteaching in mathematics teacher education: Promises and challenges. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(1), Article 2381. <https://doi.org/10.29333/ejmste/13941>
- Muñoz-Salinas, Y. M., Caro-Zúñiga, D., & Jeria, I. (2025). Creativity and preservice teachers: A literature review of an underexplored field (2014–2024). *Education Sciences*, 15(3), 395. <https://doi.org/10.3390/educsci15030395>
- Nur Fitria, T. (2025). Basic teaching skills of microteaching for graduate students' competencies as prospective teacher: What should they consider?. *Indonesian Journal of Multidisciplinary Educational Research*, 3(2), 104–123. <https://doi.org/10.30762/ijomer.v3i2.6777>
- Oktavia, Y. (2014). Kreativitas guru dalam pembelajaran di sekolah. *Jurnal Administrasi Pendidikan*, 2(1), 808–815.
- Olford, J. E. (1971). The concept of creativity. *Journal of Philosophy of Education*, 5(1), 77–95. <https://doi.org/10.1111/j.1467-9752.1971.tb00449.x>
- Papadakis, S. (2021). The impact of coding apps to support young children in computational thinking and computational fluency. A literature review. *Frontiers in Education*, 6, 657895. <https://doi.org/10.3389/feduc.2021.657895>
- Ramadhanti, D., & Yanda, D. P. (2025). Microteaching practice and educational field experiences: The impact on the professional performance of prospective teachers. *International Journal of Education and Curriculum Application*, 8(1), 103. <https://doi.org/10.31764/ijeca.v8i1.29139>
- Rizal, R., Surahman, E., Aripin, H., & Maulidah, R. (2024). Problem-based learning management system (PBLMS): A mobile learning application to facilitate creative thinking skills (CTS) of prospective physics teachers. *International Journal of Interactive Mobile Technologies*, 18(1), 97. <https://doi.org/10.3991/ijim.v18i01.46417>
- Robbers, S., Evers, A. T., & Vermeulen, M. (2023). The design process of a questionnaire measuring teachers' innovative behavior. *Cogent Education*, 11(1). <https://doi.org/10.1080/2331186x.2023.2283641>
- Santrock, J. W. (2018). *Educational psychology*. (6th ed.). McGraw-Hill Education.
- Sari, N. K., Siswandari, S., Sajidan, S., & Sukarmin, S. (2025). Exploring prospective teachers' perceptions of teaching creativity through microteaching lesson study:

- Impact on professional development. *Salud Ciencia y Tecnología*, 5, 2301. <https://doi.org/10.56294/saludcyt20252301>
- Saritepeci, M., & Durak, H. Y. (2024). Effectiveness of artificial intelligence integration in design-based learning on design thinking mindset, creative and reflective thinking skills: An experimental study. *Education and Information Technologies*, 29(18), 25175-25209. <https://doi.org/10.1007/s10639-024-12829-2>
- Sawyer, R. K. (2017). Teaching creativity in art and design studio classes: A systematic literature review. *Educational Research Review*, 22, 99-113. <https://doi.org/10.1016/j.edurev.2017.07.002>
- Sonsupap, K., Cojorn, K., Choompunuch, B., Intakanok, C., & Seesom, C. (2025). Exploring pre-service teachers' self-efficacy: The impact of community practice and lesson study. *Education Sciences*, 15(10), 1357. <https://doi.org/10.3390/educsci15101357>
- Sternberg, R. J., & Karami, S. (2022). An 8P theoretical framework for understanding creativity and theories of creativity. *Journal of Creative Behavior*, 56(1), 55-78. <https://doi.org/10.1002/jocb.516>
- Sukmawati, R., & Purbaningrum, K. A. (2021). Didactic design of lesson study-based microteaching learning for prospective mathematics teacher students. *Kreano, Jurnal Matematika Kreatif-Inovatif*, 12(1), 107-117. <https://doi.org/10.15294/kreano.v12i1.26413>
- Tamsah, H., Yusriadi, Y., Hasbi, H., Haris, A., & Ajanil, B. (2023). Training management on training effectiveness and teaching creativity in the COVID-19 pandemic. *Education Research International*, 2023(1), 6588234. <https://doi.org/10.1155/2023/6588234>
- Torres Gomez, J., Rodriguez-Hidalgo, A., Jerez Naranjo, Y. V., & Pelaez-Moreno, C. (2021). Teaching differently: The digital signal processing of multimedia content through the use of liberal arts. *IEEE Signal Processing Magazine*, 38(3), 94-104. <https://doi.org/10.1109/MSP.2021.3053218>
- Wake, G., Swan, M., & Foster, C. (2015). Professional learning through the collaborative design of problem-solving lessons. *Journal of Mathematics Teacher Education*, 19(2), 243-260. <https://doi.org/10.1007/s10857-015-9332-9>
- Wang, H., Ye, Y., Liao, X., Li, Z., & Liang, Y. (2022). A study on maker teaching activity design in senior high school general technology course for creativity cultivation. *Frontiers in Psychology*, 13, 886051. <https://doi.org/10.3389/fpsyg.2022.886051>
- Zhou, G., Xu, J., & Martinovic, D. (2017). Developing pre-service teachers' capacity in teaching science with technology through microteaching lesson study approach. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(1), 85-103. <https://doi.org/10.12973/eurasia.2017.00605a>
- Zulfikar, T., Nidawati, N., Khasinah, S., & Mayangsari, I. (2020). Indonesian students' perceived benefits of the micro-teaching course to their teaching internship. *Indonesian Journal of Applied Linguistics*, 10(1), 242-250. <https://doi.org/10.17509/IJAL.V10I1.25063>