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Improving Teaching Quality and Undergraduate Students' Critical Thinking Skills through Contextual Teaching and Learning Integrated with Lesson Study in a Basic Physics Course

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Abstract: This study aimed to improve teaching quality and undergraduate students' critical thinking skills through the implementation of the Contextual Teaching and Learning (CTL) model integrated with Lesson Study in a Basic Physics Concepts course. The study employed Classroom Action Research using the Lesson Study approach, which was conducted through four cycles consisting of the PLAN–DO–SEE stages. The participants were 60 first-semester students enrolled in the Elementary School Teacher Education Program at Universitas Negeri Padang. Data were collected through classroom observations, interviews, field notes, and a critical thinking assessment rubric. The data were analyzed descriptively by reducing, displaying, and interpreting the findings from each cycle. The results showed continuous improvement in both teaching practices and students' critical thinking skills throughout the implementation. Lesson Study enabled lecturers to design contextual lesson plans, facilitate collaborative learning, provide authentic learning experiences, and conduct reflective teaching practices. Students demonstrated progressive improvement in analyzing contextual problems, providing evidence-based reasoning, drawing conclusions, and communicating their ideas during classroom discussions. The final average critical thinking score reached 3.17 on a 4-point scale, indicating a good level of critical thinking. These findings suggest that integrating CTL with Lesson Study effectively enhances teaching quality while fostering students' critical thinking skills in Basic Physics learning.

Keywords: Contextual teaching and learning; Critical thinking skills; Lesson study; Teaching quality

Introduction

Education is the process by which a group of people acquires knowledge, abilities, and habits passed down from one generation to the next through teaching, training, or research. Although instruction is frequently facilitated by educators, individuals can also learn independently (Serdyukov, 2017; García et al., 2020; Torres-Porras & Alcántara-Manzanares, 2022). From curriculum development to the enhancement of instructional quality, the field of educational science continues to advance (Jusuf et al., 2019; Rahmawati et al., 2019). Quality education remains a key focus through both traditional and cutting-edge methodologies. However, in many instances, educational outcomes have not yet yielded anticipated results, as evidenced by low student learning outcomes—particularly in foundational science courses like Basic Concepts of

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Physics. Under such conditions, students struggle to build a solid foundation for higher-level coursework (Guo & Guo, 2017; Haug & Mork, 2021).

Students enrolled in the Elementary School Teacher Education program are required to master basic physics concepts to prepare them for their future teaching roles. To address existing learning challenges, educators must select teaching strategies that directly engage students. In this study, Contextual Teaching and Learning (CTL) integrated with Lesson Study was implemented for elementary teacher education students at Universitas Negeri Padang. Connecting learning materials to real-world situations and student needs increases learning motivation while enhancing instructional efficiency and effectiveness. Unlike traditional passive approaches, contextual learning takes place within meaningful, real-life contexts where the instructor acts primarily as a facilitator rather than a sole information provider (Velani & Retnawati, 2020; Yuwandra & Arnawa, 2020).

Initial observations revealed that students encountered significant difficulties because learning was predominantly lecture-based with limited opportunities for personal exploration. Students expressed a lack of interest due to the disconnect between academic topics and their daily experiences. Consequently, student learning outcomes—specifically critical thinking skills—remained underdeveloped. Addressing 21st-century educational demands requires fostering competencies such as information and communication technology literacy, critical thinking, problem-solving, communication, and teamwork (Fuad et al., 2017; Wrahatnolo & Munoto, 2018; Özelçi & Çalışkan, 2019; Rubach & Lazarides, 2021). Critical thinking involves reflective and self-regulatory judgment that results in interpretation, analysis, evaluation, and inference based on evidence, concepts, methodologies, and contextual considerations (Horn & Veermans, 2019; Sudirtha et al., 2021; Fikriyatii et al., 2022). Lecturers can foster critical thinking by adopting constructivist approaches such as the CTL model (Pamungkas et al., 2019; Astra et al., 2020). Critical thinking steps can generally be categorized into three main phases: problem recognition, information assessment, and problem-solving or conclusion drawing (Wartono et al., 2018; Alsaleh, 2020). These skills enable students to evaluate arguments using valid criteria. When students become accustomed to critical thinking, problem-solving becomes a natural cognitive process. However, instructional experience over the past decade indicates that many students rely solely on procedural calculations without understanding the underlying physical meaning or applying concepts in novel contexts (Laar et al., 2017; Tari & Rosana, 2019). To bridge this gap, CTL was combined with Lesson Study in this research. Lesson Study enhances educator professionalism through collaborative planning, observation, and reflection, fostering collegiality and a supportive learning community (Bjuland & Mosvold, 2018; Coenders & Verhoef, 2019). As noted by Yurnetti (2018), the core concepts of Lesson Study are straightforward: educators collaborate to design, observe, and refine instructional strategies, ultimately driving continuous quality improvement in the classroom.

Method

This study employed Classroom Action Research (CAR) integrated with the Lesson Study approach to improve teaching quality and undergraduate students' critical thinking skills in the Basic Concepts of Physics course. The study was conducted during the first semester in the Elementary School Teacher Education Program, Universitas Negeri Padang. The participants were 60 first-semester undergraduate students enrolled in the Basic Concepts of Physics course.

The research consisted of four action research cycles, and each cycle followed the standard PLAN–DO–SEE stages of Lesson Study. During the PLAN stage, the research team collaboratively designed contextual lesson plans, prepared learning materials, developed learning media, and constructed assessment instruments based on the principles of Contextual Teaching and Learning (CTL). In the DO stage, the lecturer implemented the lesson while three peer lecturers observed students' learning activities and the implementation of CTL using structured observation sheets. During the SEE stage, the lecturer and observers collaboratively reflected on the learning process, identified strengths and weaknesses, and revised the lesson plan for the subsequent cycle. This collaborative reflection enabled continuous improvement in the implementation of CTL throughout the research.

Lesson Study was employed as a collaborative professional development strategy to optimize the implementation of the CTL model rather than as an independent instructional model. Through peer observation and reflective discussion, lecturers were able to improve contextual learning scenarios, strengthen classroom interaction, and enhance students' engagement in learning activities across successive cycles.

Data were collected using classroom observation sheets, field notes, interviews, and a critical thinking skills assessment rubric. Classroom observations were conducted to evaluate the quality of CTL implementation by the lecturer, whereas the critical thinking rubric was used exclusively to assess students' learning outcomes. Data credibility was enhanced

through methodological triangulation by comparing findings from observations, interviews, and field notes.

Table 1. Critical thinking skills assessment rubric

Indicator	Score	Explanation
Basic clarification	4	Writes questions correctly, completely, and clearly identifies the problem.
	3	Writes questions correctly and completely but with minor inaccuracies or lack of clarity.
	2	Write questions correctly and completely
	1	Write questions correctly and incompletely
	0	Don't write anything
Giving reasons for a decision	4	Provides logical and accurate reasons fully supported by observation results.
	3	Provides appropriate reasons supported by observation results with minor weaknesses.
	2	Write reasons according to the results of observations correctly
	1	Writing reasons according to the results of observations is less valid
	0	Do not write reasons according to the results of observations
Conclude		Draws accurate, logical, and complete conclusions based on the available evidence.
		Draws appropriate conclusions with only minor inaccuracies.
	2	Draw the right conclusions
	1	Draw inaccurate conclusions
	0	No conclusion
Further clarification	4	Provides comprehensive explanations that strongly support the conclusions.
	3	Provides appropriate explanations that adequately support the conclusions
	2	Provide further explanation with appropriate conclusions
	1	Providing further explanation is less precise to the conclusion
	0	Does not provide further explanation of the conclusions
Conjecture and consistency		Integrates findings logically and consistently into a coherent explanation.
		Integrates findings appropriately with only minor inconsistencies.
	2	Integrate findings appropriately
	1	Combining the findings is not quite right
	0	Do not combine findings

The results of research conducted by Yurnetti (2018) shows that the introduction of lesson study for math teachers reveals a significantly improved level of lecturers in terms of learning preparation, teacher collaboration, implementation of learning strategies, use of learning tools, and improvement of learning assessment tools. Besides that, Bjuland & Mosvold (2018) also concluded that Lesson Study has been able to improve the professionalism of teachers, their knowledge and self-worth, and the caliber of their professional resources. Therefore, the goal of this study is to help students develop their critical thinking skills so that lecturers can learn more effectively, particularly when applying contextual learning.

Observation, field recording, and interview techniques are used to track the rise in lecturer professionalism in the execution of lesson studies. Improvement in critical thinking skills is calculated through indicators of critical thinking, namely: basic clarification, giving reasons for a decision, concluding, further clarification, conjecture and coherence. The evaluation of these indicators is conducted using the evaluation criteria shown in Table 1.

Furthermore, the researcher use a value scale between 0 and 4 to determine the average student score for each or all indicators.

Result and Discussion

Three steps make up the CTL implementation process in the classroom: planning, carrying it out, and analyzing each cycle. In the planning stage, it is discussed the lecturer's lesson plan, which includes instructional materials, models or strategies for learning, tools for learning, and instruments for assessment that are pertinent to the learning objectives. The lecturer altered the instructional materials in light of the discussion's findings, taking into consideration the advice and comments of his peers and the validator. The next stage is implementation, which involves carrying out the lesson plans that were developed in class. In this step, three coworkers act as observers to track and document the learning process that is being carried out by lecturers and students. They watch the lecturer while they conduct their lesson. The final element of lesson study is observation, which includes evaluation between the lecturer and observers and reflection on learning. The lecturer reflects on the learning process that has taken place and discusses many issues that have been or have not been implemented in accordance with the planned lesson. The observer then discussed his findings regarding an effective learning process based on the students' and lecturers' learning behaviors. Lecturers and observers explored several methods to improve lesson plans in the upcoming cycle based on the findings. Using the stages of lesson study, it is vital to enhance learning while doing so in a group setting.

Contextual learning applied in this study refers to CTL with learning stages in lesson study. For example, in the stimulation phase, the lecturer provides problems that may occur in everyday life related to basic physics. In the problem, students are expected to be able to

identify the data in the problem. This activity is carried out at the stage of problem orientation learning and data collection. After that, students in their groups are encouraged to connect or analyze data obtained to find solutions to given contextual problems .In this phase, students construct problems using facts, information, or knowledge they have learned before (constructivism paradigm). Students are expected to be able to understand concepts in basic physics in order to be able to draw up or formulate conclusions accurately. At the verification stage, the answers of all groups are discussed or verified to obtain the most correct understanding of problem solving. The final stage is generalization, where lecturers and students make final conclusions.

It is evident that the quality of the learning being done has significantly improved based on the findings of learning observations over four cycles and interviews with lecturers. By strengthening their capacity to, boosting the quality of lecturer learning is demonstrated. creating lesson plans that incorporate contextual learning techniques; addressing issues from the real world or in the context of daily existence; creating instructional strategies that promote critical thinking, collaboration, and active discussion among students; creating tools for evaluating students' critical thinking abilities. The collaborative system in lesson study also encourages collegial instructors to share knowledge, engage in discussion, and be more receptive to criticism and ideas regarding the learning process they are carrying out (Hendawati et al., 2019; Hyun et al., 2020).

Learning outcomes, in this example, critical thinking abilities, can be used as one measure of the effectiveness of the learning process. The development of critical thinking abilities can be observed by indications of those abilities. The following table displays the average value of critical thinking abilities for each indicator.

Table 2. Average problem solving score

Cycel	Basic clarification	Giving reasons	Conclusion	Further clarification	Conjecture and consistency	Critical	Thinking skills average score
1	2.34	2.56	2.67	2.87	3.12		2.712
2	3.22	2.46	2.76	3.09	3.16		2.938
3	3.59	2.88	3.22	2.59	3.77		3.210
4	3.31	3.27	3.73	3.17	3.89		3.474
	3.58	3.74	3.72	2.69	3.88		3.522
Average							3.1712

The information in the table above demonstrates that the average score of students' critical thinking abilities has gone up for each indicator. "Very good" is the required grade for the third test. The average score for pupils' critical thinking abilities is 3.1712, which falls under the good standard. The first question's average score for critical thinking abilities among students is 2.712, which meets the good standard. The second question's average score for critical thinking abilities among students is 2.938, which meets the good standard. The third question's average score for critical thinking abilities among students is 3.210, which meets the good standard. The average score for students' critical thinking abilities in the fourth question is 3.474, which meets the very good standard. The last question's average score for critical thinking abilities across students is 3.522, which meets the very good standard. The evidence suggests that teaching physics fundamentals in a contextualized way can help students develop their critical thinking abilities.

The study's findings demonstrate how each indicator demonstrates the development of pupils' critical thinking abilities. After using contextual learning, the scoring categories for all metrics are excellent. Students are presented with real-world problems during the learning process using a contextual approach, which forces students to dig deeper into the information and data already available, access information needed in problems to assist them solve problems, and seek for situations that might develop in problems.

Enhancement students' critical thinking skills through contextual learning in line with research conducted by Johar et al. (2018), Oktrisma & Ratnawulan (2021), Solehah et al. (2021), Asrizal et al. (2021), Hidayati et al. (2020), Yunita & Aufa (2020), Juniwati et al. (2020), Kurniasari et al. (2018), and Khoiri et al. (2021) which states that the group with contextual learning has better critical thinking skills compared to the group with conventional learning. Besides that, Tari & Rosana (2019) in his research revealed that to enhance critical thinking abilities through contextual learning also demonstrates that individuals with poor levels of critical thinking abilities boost their critical thinking abilities after putting what they have learned into practice. Students with medium and high levels of critical thinking ability, however, frequently exhibit stability.

This indicates that students' critical thinking abilities can be enhanced by learning in a contextualized manner.

Through a positive response to the implementation of the learning model, this study also reveals that employing the learning phases in the contextual learning model can be well welcomed by students. As students and instructors discussed and exchanged perspectives, the learning environment was dynamically captured. Along with positive responses, students also demonstrate improvement in a number of learning-related attitudes, including responsibility, the capacity for opinion expression, systematic thought, active knowledge seeking, cooperation, the courage to ask questions, involvement in the learning process, independence, creativity, respect for others' opinions, and the ability to inspire curiosity.

Conclusion

This study demonstrates that the implementation of Contextual Teaching and Learning (CTL) integrated with Lesson Study effectively improved both teaching quality and undergraduate students' critical thinking skills in the Basic Concepts of Physics course. Through the collaborative PLAN–DO–SEE cycles, lecturers continuously refined contextual learning activities, resulting in more student-centered instruction and more meaningful classroom interactions. Students' critical thinking skills showed a progressive improvement across the four action research cycles, increasing from a fair level in the initial cycle to a good level in the final cycle. The final average critical thinking score reached 3.17 on a 4-point scale, indicating that students became more capable of analyzing contextual problems, providing evidence-based reasoning, drawing logical conclusions, and communicating scientific ideas effectively. These findings indicate that integrating CTL with Lesson Study provides an effective approach to enhancing both instructional quality and students' critical thinking skills in higher education physics learning. Future studies are recommended to implement CTL integrated with Lesson Study in different science disciplines and educational contexts to examine its broader applicability. Further research may also involve larger participant groups, longer implementation periods, and additional learning outcome variables, such as problem-solving ability, scientific literacy, and creative thinking, to provide a more comprehensive evaluation of the effectiveness of this instructional approach.

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Author Contributions
Atika Ulya Akmal conducted the study by developing the instruments, collecting data, analysis, and write papers. Others authors can be written to provide scientific input and suggestions in this study, data analysis and article writing and article improvement. All authors have approved the final version.

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The authors declare no conflict of interest.

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