



The Influence of Various Types of Flipped Classroom Assisted by Learning Management System (LMS) on Creative Thinking Skills in Junior High School Students

Azmi Fathin Eka Nugraha¹, Adnan^{1*}, Firdaus Daud¹

¹Universitas Makassar, Makassar, Indonesia.

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Corresponding Author:

Adnan

adnan@unm.ac.id

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Abstract: This study aims to analyze the effect of various types of flipped classrooms (Mastery Flipped, Peer Instruction Flipped, and Problem-Based Learning Flipped) assisted by Learning Management System (LMS) on creative thinking skills. The research design used is pretest-posttest control group design. The type of research is experimental. The research population came from grade VII students of SMP Negeri 17 Baubau consisting of 5 classes. The research sample consisted of 104 students consisting of 4 classes. The type of instrument used was a creative thinking ability test which aims to assess the impact of the implementation of flipped classrooms on students' creative thinking skills. The test was given before and after the implementation of flipped classrooms. The data collection technique used was simple random sampling. The data analysis used was descriptive and inferential data analysis, namely by conducting normality, homogeneity, ANCOVA, and LSD tests. The results showed that the three types of flipped classrooms had a significant effect on improving creative thinking skills, with the PBL-Flipped type showing the highest average score. Problem-based discussions in PBL-Flipped train students to see problems from various perspectives, generate unique solutions, and improve analytical and innovative skills. In addition, the use of LMS strengthens the effectiveness of the flipped classroom by providing flexible access to materials, increasing interaction between teachers and students, and creating a more personal and dynamic learning environment.

Keywords: Creative thinking; Flipped classroom; Learning management system (LMS); Mastery flipped; Peer instruction flipped

Introduction

In the rapidly developing digital era, 21st century skills are a must for students to be able to compete and adapt to the changes that continue to occur. 21st century skills include various competencies, namely 4C which include: Communication, Collaboration, Critical Thinking and problem solving, and Creative and Innovative (Thornhill-Miller et al., 2023; Azmi et al., 2024). Individuals who have 21st century skills are better prepared to face the challenges of the increasingly

complex world of work and social life. Therefore, the education system must be able to accommodate the development of these skills by implementing innovative and technology-based learning strategies. 21st century skills highlight students' abilities to adapt, create, and solve problems, which are specifically analyzed through the perspective of cognitive flexibility (Bayley, 2022). Cognitive flexibility refers to a person's ability to adjust their mindset, see a problem from various perspectives, and find innovative solutions in dynamic situations (Tong et al., 2023). The framework for 21st century

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learning groups learner learning outcomes into three main categories: learning and innovation skills, information, media and technology skills, and life and career skills.

In particular, learning and innovation skills include aspects of creativity and innovation that are much needed in facing an increasingly complex world (Kwangmuang et al., 2021; Herlinawati et al., 2024). Therefore, it is very important for the next generation to be equipped with creative thinking skills so that they are able to adapt to the changing times. Creative thinking skills are one of the main aspects that need to be developed in education. Creative thinking is not only about generating new ideas, but also includes aspects of fluency, flexibility, originality, and elaboration in solving a problem (Rosiana et al., 2024). This skill is very important in facing the challenges of the 21st century, which requires individuals to innovate and adapt to rapid changes. Unfortunately, there are still many students who are less skilled in creative thinking because the learning approach is still conventional and teacher-centered. Creative thinking is closely related to cognitive capacity. Creative thinking includes cognitive control mechanisms, such as executive function, working memory, mind wandering, and cognitive inhibition (Schäfer et al., 2024). Creative thinking skills are also associated with more trainable cognitive skills, such as problem finding, problem solving, divergent thinking, critical thinking, and brainstorming (Benedek & Fink, 2019).

The constructivist learning paradigm integrated with technology emphasizes the active involvement of students in problem solving and the development of creative thinking skills, while opening up new opportunities to increase the effectiveness of the learning process. Therefore, a more innovative learning approach is needed to improve students' creative thinking skills. One learning model that has been proven effective in improving creative thinking skills is the Flipped Classroom (Istofany et al., 2024). This model changes the traditional learning method by reversing the learning sequence: students study the material independently before face-to-face sessions, then class time is used for discussion, analysis, and collaborative problem solving. This approach allows students to be more active in exploring concepts, developing innovative solutions, and connecting theory with practical applications in real life. This is different from conventional learning methods which tend to be one-way, where students only receive information from the teacher without much opportunity to think creatively. In addition, the effectiveness of the Flipped Classroom model can be further enhanced with the help of a Learning Management System (LMS) (Ruslan et al.,

2024; Alyoussef, 2022). LMS is a digital platform that supports learning by providing flexible access to materials, enabling more dynamic interactions between students and teachers, and supporting various innovative learning methods (Baroroh et al., 2024).

LMS allows teachers to provide and share documents, assignments, quizzes, glossaries, forums, chats, and wikis in an easy way, and create quality online learning. With LMS, students can learn at their own pace, access wider learning resources, and get direct feedback from teachers and fellow students. Information and communication technology allows students to communicate with their friends anywhere, exchange perspectives, and discuss and develop ideas with each other. Research conducted by Gunawan et al. (2024), shows that the use of LMS in learning not only improves conceptual understanding but also strengthens creative thinking skills by providing space for students to be creative, experiment, and develop new ideas. The implementation of Flipped Classroom assisted by LMS has several advantages in supporting the development of creative thinking skills. First, students are more active in seeking information and understanding the material before class sessions, so they have a better initial understanding.

This process helps them develop divergent thinking skills, which is one of the main aspects of creative thinking. Second, the use of LMS allows students to organize their ideas more systematically, explore various alternative solutions, and test and evaluate the results of their thinking (Fanshawe & Barton, 2023). Third, interactions in a digital environment provide opportunities for students to collaborate, discuss, and gain a broader perspective in solving problems, which can trigger student creativity (Schmoelz, 2018). Conventional learning methods (lectures) that are still widely used by teachers in schools cause students' weak ability to construct meaning about what is being learned (Ngaeni & Saefudin, 2017). Flipped Classroom assisted by LMS changes this paradigm by giving students the opportunity to understand the material independently before the class session begins. Thus, face-to-face time can be used to discuss concepts in more depth and solve problems collaboratively. This not only increases learning motivation but also trains students to think more flexibly, innovatively, and be better prepared to face challenges in the real world. Furthermore, LMS has an important role in accommodating various learning styles of students by providing flexibility in accessing materials, interacting with teachers and peers, and exploring various learning resources. Some students may understand material better through videos, while others prefer reading or interactive discussions.

LMS enables this flexibility by providing various formats of learning materials (Mella-Norambuena et al., 2024; Barua & Lockee, 2024). In addition, LMS also allows project-based assessments and forum-based discussions that can encourage learners to explore their ideas in more depth. However, although many studies have shown the effectiveness of Flipped Classroom and various innovative learning approaches separately, there are still few studies that specifically discuss how the implementation of Flipped Classroom with LMS support can impact students' creative thinking skills (Chen et al., 2023). Therefore, this study aims to explore the effect of the implementation of Flipped Classroom assisted by LMS on students' creative thinking skills. Through this study, it is expected to find empirical evidence regarding the effectiveness of this learning model as well as recommendations for educators in designing more innovative learning strategies that are in accordance with the needs of students in the digital era. Thus, the results of this study are expected to contribute to the development of more innovative and effective learning strategies to improve creative thinking skills in the digital era. It is also hoped that this study can be a basis for policy makers in the world of education to apply learning methods that are more in accordance with the demands of the times and the needs of today's students.

Method

Research Type

This study uses a true experimental quantitative research method. This study focuses on systematic data collection and analysis to explain the effect of the three types of flipped classrooms on creative thinking skills.

Research Design

The research design uses a pretest-posttest control group design. This design was chosen because it can describe the effect of the various types of flipped classrooms as independent variables on creative thinking skills as dependent variables.

Research Subjects

The research population came from grade VII students of SMP Negeri 17 Baubau consisting of 5 classes. The research sample consisted of 104 students consisting of 4 classes. This research was conducted in the even semester of the 2025-2026 academic year.

Independent Variables

Three types of flipped classrooms were used: mastery flipped, peer instruction flipped and problem based learning flipped. Three experimental treatments

were designed based on the type of flipped classroom and the control treatment used the STAD (Student Teams Achievement Division) model.

Dependent Variable

The dependent variable is creative thinking skills. The test consists of 8 descriptive questions according to Guilford's creative thinking indicators, namely fluency, flexibility, originality, and elaboration. Each item is counted as ten points, meaning the maximum points for the test are 80. The points obtained by students are divided by the maximum number of points then multiplied by 100. This test is assessed by two education experts to assess the accuracy of the questions, their relevance to the creative thinking indicators, their relevance to the human circulatory system material and assessment. The experts concluded that this test is appropriate, some sentence modifications are needed and this test is ready to be applied to the sample.

Experimental Procedure and Data Collection

Giving a pretest to the experimental class and the control class at the beginning of learning to measure students' initial abilities related to creative thinking skills in three experimental classes and one control class. The pretest is applied to all groups to ensure homogeneity between groups; Implementing learning in class. The material consists of the differences between living things and non-living things based on their characteristics, techniques for grouping living things, making classification keys to identify living things around the school, the characteristics of each kingdom of living things, and the role of living things in human life; Giving a posttest to the experimental class and the control class after all the topics have been taught at the last meeting. The data is processed and analyzed statistically using the one-way ANCOVA (Analysis of Covariance) test to determine the effect of the flipped classroom. The LSD (Least Significant Different) test is applied to compare the types of flipped classrooms in pairs and detect significant differences.

Result and Discussion

Analysis of Creative Thinking Ability Indicators on Pretest Scores

Table 1. Analysis of Creative Thinking Skills for Each Indicator on Pretest Scores

Media/Indicator	Fluency	Flexibility	Originality	Elaboration
Mastery Flipped	40.94	40	41.44	40.87
Peer Instruction Flipped	36.40	37.28	37.40	38.14
PBL Flipped	36.94	37.50	38.89	39.17

Media/Indicator	Fluency	Flexibility	Originality	Elaboration
STAD	33.94	34.72	35	35.56
Average	37.05	37.38	38.18	38.44
Category	Not enough	Not enough	Not enough	Not enough

Based on Table 1, the creative thinking ability on each creative thinking indicator for the pretest score is in the sufficient category.

Analysis of Creative Thinking Skill Indicators on Posttest Scores

Based on Table 2, the creative thinking ability on each creative thinking indicator is in the very good category.

Table 2. Analysis of Creative Thinking Ability of Each Indicator on Posttest Scores

Media/Indicator	Fluency	Flexibility	Originality	Elaboration
Mastery Flipped	76.25	74.42	75.10	76.88
Peer Instruction Flipped	75	76.40	74.80	75.25
PBL Flipped	80.74	81.30	82.04	83.70
STAD	70	71.50	72.25	72.60
Average	75.50	75.91	76.05	77.11
Category	Good	Good	Good	Good

Normality Test

Based on Table 3, the results of the normality test in the class taught with the LMS-assisted flipped classroom and the class taught with STAD using the Shapiro-Wilk test showed a normal distribution. This is because the significance value in the four classes is greater than the significance level (α) of 0.05.

Table 3. Normality Test of Pretest and Posttest Values in Each Group

Model		Sapiro-Wilk	Description
Mastery Flipped	Pretest	0.12	Normal
Peer Instruction Flipped		0.12	Normal
PBL Flipped		0.21	Normal
STAD (control)		0.11	Normal
Mastery Flipped		0.18	Normal
Peer Instruction Flipped	Posttest	0.21	Normal
PBL Flipped		0.19	Normal
STAD (control)		0.10	Normal

Homogeneity Test

Based on Table 4, the values obtained from the pretest and posttest for all classes have a significance value of 0.778 and 0.417. From these data, the four classes show homogeneous data, meaning that the population has a significance value greater than the significance level (α) of 0.05.

Table 4. Homogeneity Test of Pretest and Posttest Values

Data	Levene Statistic	Sig.	Description
Pretest	.366	0.778	Homogeneous
Posttest	.954	0.417	Homogeneous

Hypothesis Test

The results of the ANCOVA test of the effect of LMS-assisted flipped classroom on creative thinking skills can be seen in Table 5.

Table 5. Hypothesis Test of the Effect of LMS-Assisted Flipped Classroom on Creative Thinking Skills

Source	Sum of Squares	Type III	Db	Mean Square	F	.Sig
Intercept	3041.99		1	3041.99	261.57	.000
Pretest	994.28		1	994.28	85.49	.000
Class Model	703.25	Model Class	3	234.41	20.15	.000
Error	1151.31		99	11.62		
Total	611167.56		104			
Intercept	3041.99		1	3041.99	261.57	.000

Based on Table 5, the results of the ANCOVA test on the media with a value of $F = 20.157$ with a sig value of $0.00 < 0.05$ (significance value less than 0.05) then H_0 is rejected and H_1 is accepted. Thus it can be concluded that there is an influence of mastery flipped learning, peer instruction flipped, and PBL flipped on students' creative thinking skills in the classification of living

things. If there is an influence of the implementation of the flipped classroom on creative thinking skills, then the analysis is continued with further testing using the LSD (Least Significant Difference) test analysis, to see the independent variables that have a significant influence on the dependent variable. The results of further testing with the LSD test can be seen in Table 6.

Table 6. Further Test of the Effect of Flipped Classroom Assisted by LMS on Creative Thinking Skills

Variables	Class	Average Difference	Sig.	Decision
Creative Thinking Skills	Peer Instruction Flipped dan Mastery Flipped	5.444	0.000	Significant
	Peer Instruction Flipped and STAD	2.005	0.042	Significant
	Problem Based Learning Flipped dan Mastery Flipped	7.497	0.000	Significant
	Problem Based Learning Flipped dan Peer Instruction Flipped	2.053	0.032	Significant
	Problem Based Learning Flipped dan STAD	4.058	0.000	Significant
	STAD and Mastery Flipped	3.439	0.003	Significant

Furthermore, to determine the type of flipped classroom that is better in implementing learning with mastery flipped, peer instruction flipped, and PBL flipped for the creative thinking ability variable can be seen based on the values in each estimated marginal means value. The results of the further test for the creative thinking ability variable can be seen in Table 7.

Table 7. Corrected Average Value in the Further Test

Media	Average
Mastery Flipped	72.378 ^a
Peer Instruction Flipped	77.822 ^b
Problem Based Learning Flipped	79.875 ^c
STAD	75.817 ^d

Based on Table 6, it can be seen that there is a significant influence between the four learning models. This difference can be seen in the results of further tests which provide a meaning of the difference in the influence of LMS-assisted flipped classroom on creative thinking skills. It can be seen that the PBL flipped type has a more optimal effect on creative thinking skills, followed by peer instruction flipped, STAD, and mastery flipped. The problem-based learning flipped type accompanied by a discussion method requires students to actively seek information and be sensitive to various problems around them, so that they are more accustomed to linking the theories they learn with situations or problems that occur in everyday life (Suryanto et al., 2021). In addition to improving conceptual understanding, problem-based learning flipped also plays a significant role in improving creative thinking, which includes flexibility, originality, fluency, and elaboration in thinking (Tursynkulova et al., 2023). This type encourages students to think broadly and find various ideas and solutions in solving a problem.

Choi et al. (2024), stated that by looking at problems from various perspectives, students become more creative and innovative in finding solutions. In addition, this type also trains them to produce unique solutions, not only understanding concepts, but also using their knowledge to find various solutions according to the situation at hand. Through discussions that focus on real problems, students learn to think more openly and find new ways to solve a problem (Kardoyo et al., 2020). The peer instruction type is the second most influential type of flipped classroom after problem-based learning

flipped. In the implementation of flipped classroom learning, the peer instruction flipped type directs students to explore information from learning materials before class meetings so that students can understand the material thoroughly (Chang et al., 2021; Darling-Hammond et al., 2024).

Students who are passive in class become active participants in learning by discussing and exchanging opinions with other students in the class (Ting et al., 2023). This is what will make students directly involved in constructing their knowledge, while teachers play a role in organizing discussions in class and providing feedback so that students can find out how far they understand the material studied outside the classroom (Van Alten et al., 2019). Research conducted by Lin et al. (2024), shows that a learning environment that supports interaction and active exploration of ideas can increase student creativity. This is in line with the implementation of flipped peer instruction, where students not only passively receive information but also actively build their understanding through exchanging ideas with peers (Bangun & Naphiah, 2021). In addition, the interactions that occur in flipped peer instruction also allow students to develop reflective thinking skills. When they receive responses or questions from peers, they must be able to re-evaluate their answers and correct understandings that may still be less than perfect (Jageer Singh & Raja Harun, 2021). The ability to reflect on one's own understanding and accept new perspectives contributes to strengthening creative and flexible thinking patterns. Mastery flipped is a type of flipped classroom that has an impact on creative thinking skills after STAD. This is because STAD emphasizes teamwork and social interaction more than mastery flipped, which emphasizes independent learning outside the classroom before discussions that tend to be analytical and conceptual rather than exploratory. This is in line with the results of research conducted by Isaksen (2023), which states that social skills greatly influence the process of creative problem solving, making it easier for students to complete creative tasks. Discussions that take place in groups allow for the emergence of different points of view, so that students can develop more flexible and innovative ways of thinking (Hu et al., 2022). However, mastery flipped still contributes to improving creative thinking

skills, especially through the in-depth understanding that students gain before discussions in class. Students are given the opportunity to watch learning videos before entering class. This process is in line with the Information Processing Theory developed by Atkinson and Shiffrin, which explains that information is processed through three main stages: sensory memory, short-term (working) memory, and long-term memory (Malmberg et al., 2019).

In addition, the effectiveness of flipped classroom learning in improving creative thinking skills can also be strengthened by using a Learning Management System (LMS). LMS functions as a platform that provides flexible access to learning materials, enabling more dynamic interactions between students and teachers (Jagtap et al., 2024; Maqbool et al., 2024; Maslov et al., 2021). LMS allows students to access learning materials at any time and according to their learning pace (Cavus et al., 2021). So that LMS can create a more flexible learning experience and suit the needs of each student (Nyaaba et al., 2025). LMS not only provides learning materials, but also allows students to learn in the most effective way for them, express their ideas, and use a variety of innovative learning methods. This is in line with Gligorea et al. (2023), who stated that the LMS platform can create a personalized learning environment, foster self-expression and creativity, and support creative learning strategies.

Conclusion

The research findings show that Problem-Based Learning (PBL) Flipped, Peer Instruction Flipped, Mastery Flipped, and STAD have a significant effect on students' creative thinking skills. The results of the hypothesis test using the ANCOVA test showed a significance value of 0.00 with a significance level (α) of 0.05. So that the significance value is smaller than the significance level (α) of 0.05, then H_0 is rejected and H_1 is accepted. Based on the results of the LSD further test analysis, Problem-Based Learning Flipped was found to have the strongest effect on creative thinking skills. This is because the problem-solving approach combined with the discussion method encourages students to think flexibly, originally, and elaborately in finding various solutions to real problems. With this approach, students can connect theory with practice, explore ideas widely, and develop innovative thinking. The application of flipped classrooms in learning is also increasingly optimal with the support of the Learning Management System (LMS), which provides flexibility in accessing materials and enriches the learning experience. This study emphasizes the importance of selecting innovative learning methods that encourage active interaction,

exploration of ideas, and problem solving to improve students' creative thinking skills in schools.

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Conceptualization, A. F. E. N.; methodology, A.; validation, F. D.; formal analysis, A. F. E. N.; investigation, A.; resources, F. D.; data curation, A. F. E. N.; writing—original draft preparation, A.; writing—review and editing, F. D.; visualization, A. F. E. N. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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