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The Implementation of Discussion-Comparison with Critical Analysis and Extended Learning Community on Students' Motivation and Learning Outcomes

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Abstract

This study aims to analyze the effect of applying the Discussion-Comparison with Critical Analysis and Learning Community Extended methods on student motivation and cognitive learning outcomes in Biology at SMA Negeri 7 Bengkulu. This study uses a quasi-experimental design with a Nonrandomized Control-Group Pretest-Posttest design. The research sample consisted of two classes: the experimental class, taught using innovative methods, and the control class, taught using conventional methods. The research instruments were a validated motivation questionnaire and a multiple-choice cognitive learning outcome test. The data were analyzed using the Mann-Whitney test and N-Gain calculations. The results showed that students in the experimental class had higher learning motivation than those in the control class. In addition, the increase in cognitive learning outcomes in the experimental class was also more significant, with an average N-Gain of 0.7225 (high category). In contrast, the control class only reached 0.1020 (low category). These findings prove that integrating critical discussion with practitioner involvement can increase students' motivation, conceptual understanding, and analytical skills. Thus, this method is more effective than conventional learning in improving students' cognitive outcomes.

Keywords: cognitive learning outcomes, critical analysis, discussion-comparison, extended learning community, learning motivation

INTRODUCTION

Education involves conscious efforts to create a pleasant learning environment for students so that they can actively reach their potential (Pristiwanti et al., 2022). In the world of education, one important component in determining the level of student learning is students' ability to motivate themselves (Nidawati, 2024; Pranahadi et al., 2024). According to Saksasana (2024), learning motivation is crucial for enhancing motivation, enthusiasm, and excitement during the learning process. A motivated learner possesses abundant energy to engage in the learning process. A successful learning process also fosters strong learning motivation among students. A student who has a goal to achieve needs internal motivation to achieve it (Sunarti, 2024). With motivation, students will make every effort to achieve their goals, resulting in good learning outcomes (Harahap et al., 2021). Student learning outcomes are influenced by their motivation. Their motivation contributes positively to student learning outcomes (Pratama & Cahaya, 2025). Motivation has a strong relationship with learning outcomes; if motivation to learn is high, learning outcomes will improve (Shanti & Ukit, 2018).

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Observations at SMA Negeri 7 Kota Bengkulu indicate that students have different motivations for learning biology and that their learning outcomes differ. To increase student engagement, teachers have tried to implement the problem-based learning (PBL) model. It appears that PBL can help some students solve everyday problems and foster enthusiasm for learning when presented with real-life contexts. However, the effectiveness of PBL in the classroom is greatly influenced by student readiness and the teacher's ability to guide the discussion. Not all students are able to maintain concentration and participation, and some still have difficulty connecting problems with the biology concepts being studied, so cognitive learning outcomes have not shown significant improvement. To solve this problem, more effective learning strategies must be used to encourage active student involvement, both verbally and nonverbally. One relevant alternative is the innovative method. Through discussions with critical analysis, students are encouraged to express their opinions, compare various views, and develop critical and analytical thinking skills (Lawless & Chen, 2019).

This is a discussion method consisting of four groups: 1) the student group presenting, 2) the first comparator, 3) the second comparator, and 4) the group listening or participating in the discussion. and Critical Analysis: Critical analysis of journal articles relevant to the learning theme. The components of critical analysis of articles include: 1) book title, author, publisher, and topic, 2) author's purpose, 3) concepts emerging from the article, 4) unique and interesting facts, 5) questions arising from the article, 6) tentative answers to questions, and 7) self-reflection (Lawless & Chen, 2019; Irwandi & Hasan, 2021). Meanwhile, the Extended Learning Community concept brings in practitioners from outside the school, such as doctors, farmers, or community leaders, as additional learning resources, making learning more applicable and contextual. With expanded community-based learning, students gain direct insight from practitioners, making the subject matter more meaningful and applicable (Irwandi, 2020). These two methods have a complementary relationship. Discussion-Comparison with Critical Analysis emphasizes strengthening students' critical thinking skills in the classroom, while the Extended Learning Community provides real learning experiences through interaction with practitioners. The combination of the two is expected to increase students' motivation and learning outcomes in biology.

The novelty of this research lies in the integration of two learning strategies, both applied simultaneously in biology education at the high school level. The research by Irwandi et al. (2024) focuses primarily on increasing student learning activities, whereas this study directly tests the effects of both strategies on the motivation and cognitive learning outcomes of high school students. In addition, the Extended Learning Community in this study is not limited to a concept but actually brings practitioners from outside the school into the learning process to provide a more concrete, applicable, and meaningful learning experience. Another novelty is the research context at SMA Negeri 7 Kota Bengkulu, which has not been previously studied using this combination of methods. Thus, it is hoped that this study will provide new theoretical and practical benefits to improve student motivation and learning outcomes. This study aims to determine the application of Discussion-Comparison with Critical Analysis and Extended Learning Community on student motivation and learning outcomes.

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RESEARCH METHOD

This research is a quasi-experiment with a Nonrandomized Control-Group Pretest-Posttest design (Leedy & Ormrod, 2019). The research was conducted at SMA Negeri 7 Bengkulu in October 2024. The research subjects were 10th-grade MIPA students, with two classes selected as the sample: one as the experimental group and the other as the control group. The research design is shown in Table 1.

Table 1. Nonrandomized Control-Group Pretest-Posttest Design

Group	Pretest	Treatment	Posttest
Experimental	O_1	X_1	O_2
Control	O_1	-	O_2

(Source: Leedy & Ormrod, 2019)

Explanation:
O1 = Pretest, O2 = Posttest, X = Discussion-Comparison with Critical Analysis and Learning Community Extended

The research instruments consisted of a cognitive learning test comprising 30 multiple-choice questions designed to measure students' cognitive learning outcomes based on Bloom's taxonomy levels C1 (remembering), C2 (understanding), C3 (applying), and C4 (analyzing), a learning motivation questionnaire using a five point Likert scale with scoring ranging from 1 to 5, where 1 strongly disagree, 2 disagree, 3 undecided, 4 agree, and 5 strongly agree with indicators of Attention, Relevance, Confidence, and Satisfaction, and documentation in the form of notes and photos of learning activities. Data were collected through cognitive learning pretest and posttest results, completion of the learning motivation questionnaire, and documentation of learning activities. The research procedure consisted of three stages. First, preparation involved developing learning tools, preparing research instruments, validating the instruments with expert lecturers, and preparing learning equipment. The implementation stage involved administering *the pretest,* applying the learning method to both classes as designed, and concluding with *the posttest.* Third, the final stage involves using statistical software to process pretest and posttest data and analyzing the differences in learning motivation scores and cognitive learning outcomes between the experimental and control classes. The learning implementation stage is detailed in Table 2.

Table 2. Learning steps

No	Activity Stage	Learning Activities
1	Introduction	The teacher explains the learning objectives and strategies. Introduction to practitioners The teacher and students share their experiences with the learning material.
2	Main	The teacher delivers the lesson clearly. Students in the presenting group present their critical analysis results and guide the discussion. Students in comparison group 1 present the results of their critical analysis and provide feedback to the presenting group. The presenting group responds to the comparison with comparison group 1. Students in comparison group 2 present the results of their critical analysis and provide feedback to the presenting group as a comparison. The presenting group responds to the comparison from comparison group 2. Students discuss with other participating groups about learning materials that they do not yet understand. The teacher provides feedback on the issues discussed.
3	Closing	Students compile the results of their critical analysis and conclusions from

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	the discussion. The teacher conducts evaluations and follow-ups on the learning process.

(Source: Irwandi et al., 2024)

Data processing in this study used SPSS version 26. Data analysis was carried out in several stages: normality testing with the Shapiro-Wilk test, homogeneity testing with the Levene Test, and hypothesis testing with the Independent Samples t-test. If the data did not meet the assumptions of normality or homogeneity, an alternative nonparametric test was used, namely the Mann-Whitney U test. In addition, the improvement in student learning outcomes was analyzed using the N-Gain test with the following formula:

$$\mathrm{N-Gain} = \frac{Posttest\ Score - Pretest\ Score}{Ideal\ Score - Pretest\ Score}$$

(Source: Hake, 1999)

RESULTS AND DISCUSSION

Results of Student Motivation to Study Biology

To measure student learning motivation, a questionnaire consisting of 24 statements with five answer choices was used, namely strongly disagree, disagree, unsure, agree, and strongly agree. A summary of student learning motivation data is shown in Figure 1.

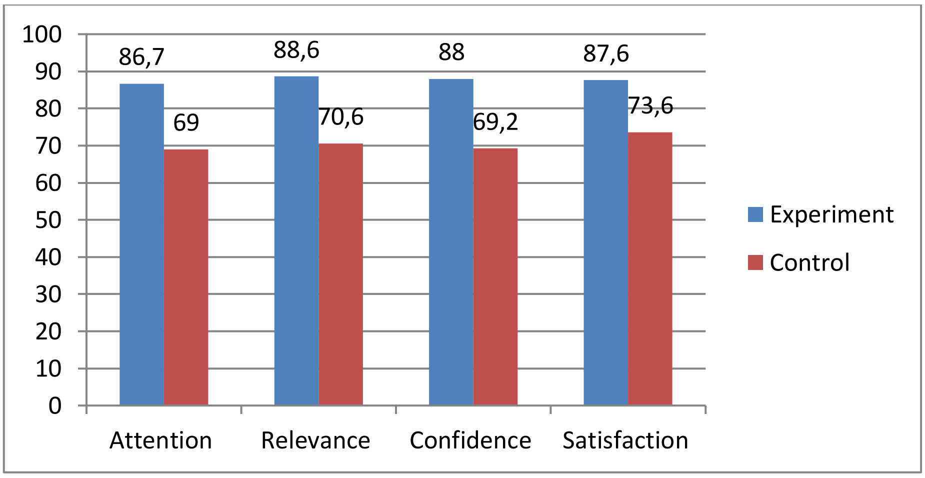

Figure 1. Learning Motivation Percentage Results

According to Figure 1, the average learning motivation of students in the experimental class was 87.7%. It was categorized as good, while in the control class, it was only 70.6%, which was categorized as fairly good. When viewed from each perspective, the experimental class scored higher: 86.7% for attention, 88.6% for relevance, 88% for confidence, and 87.6% for satisfaction. Meanwhile, the control class only scored 69% for attention, 70.6% for relevance, 69.2% for confidence, and 73.6% for satisfaction. These results show that the application of learning in the experimental class encouraged greater student motivation for learning than conventional learning in the control class.

The results of the learning motivation questionnaire analysis in Figure 1 show that students in the experimental class who used innovative learning methods had higher motivation levels than those

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in the control class, which used conventional learning methods at school. The average learning motivation of students in the experimental class reached 87.7%, which is categorized as good, while that of the control class reached 70.6%, which is categorized as fairly good. This difference shows that the use of these two methods significantly increases student learning motivation.

The analysis of the application of this method was conducted using a t-test. However, before the t-test was carried out, normality and homogeneity tests were conducted. A summary of the results of these two tests is shown in Table 3.

Table 3. Results of the Normality Test and Homogeneity Test of Learning Motivation

Class	*Shapiro-Wilk*				*Test of Homogeneity of Variance*				
	Statistic	*Df*	*Sig*	Description	*Levene Statistic*	*df1*	*df2*	*Sig.*	Description
Experiment	0.977	30	0.754	Normal	1.901	1	58	0.173	Homogeneous
Control	0.935	30	0.068	Normal					

Based on Table 3, the p-value in the experimental class is 0.754, which is greater than 0.05 (0.754 > 0.05), while in the control class it is 0.064 (0.064 > 0.05). Thus, it can be concluded that the data from both groups are normally distributed. Next, a homogeneity test was conducted to examine the similarity of the variance in student learning motivation data. The test results showed a p-value of 0.173, which is greater than 0.05 (0.173 > 0.05), so the data variance is homogeneous. The next analysis was a t-test, with the results shown in Table 4.

Table 4. Results of the t-test for the learning motivation questionnaire

Independent Samples Test

		Learning Motivation	
		Equal variances assumed	*Equal variances not assumed*
Levene's Test for Equality of Variances	F	1.901	
	Sig.	.173	
	T	34,075	34,075
	Df	58	50,812
	Sig. (2-tailed)	,000	.000

Referring to Table 4, the t-test results for student learning motivation yielded a p-value of 0.000, which is smaller than 0.05 (0.000 < 0.05). Thus, H0 is rejected and H1 is accepted. In other words, there is a difference in biological learning motivation between students in the experimental and control classes. The learning motivation t-test results shown in Table 4 indicate a significance value of 0.000 (p < 0.05). This finding confirms a significant difference in learning motivation between students in the experimental and control classes.

This aligns with the findings of Irwandi et al. (2024), who found that critical discussion and community-based learning can increase motivation through active participation and social support in the classroom. The research reveals that fostering an inclusive learning community can increase student motivation by providing a sense of involvement and social support during the learning process. In the experimental class, the highest aspect of learning motivation was *relevance* (the material's relevance to students' lives), with a score of 88.6%. This shows that students feel that the learning provided is not only meaningful but also relevant to their real experiences (Priniski et al., 2019). The learning process, which involves critical analysis, comparative discussions, and peer reflection, encourages students to actively relate the material's concepts to everyday situations. These results align with the research by Abdullah (2025), which confirms that students are able to significantly increase their learning motivation. The highest indicator in this aspect is "feeling motivated to learn," which reflects that students' active involvement in the discussion and critical analysis process strengthens their intrinsic motivation, as explained by Irwandi & Hasan (2021). However, the lowest motivation aspect in the experimental class was attention, with a score of 86.7%. Although this is still in the good category, it indicates a challenge in maintaining students' focus on the task. The lowest indicator was "attention to tasks," which showed that some students were still inconsistent in completing the tasks assigned to their groups. Observations during the learning process revealed that, in the early stages of preparing critical analysis results, some students remained passive and waited for instructions, and that differences in time management between groups affected the smooth completion of tasks. This is reinforced by the research of Nasriani & Afiah (2025), which emphasize the importance of self-regulation and time management so that students are able to maintain attention and consistency in completing group assignments.

In the context of the control class, the highest learning motivation score was observed in the satisfaction aspect at 73.6%, indicating that students were mostly satisfied with the PBL learning process. This aspect of satisfaction relates to students' feelings of happiness and the fulfillment of expectations during the learning process, in line with the findings of Putri et al. (2025), which confirm a positive relationship between motivation and learning satisfaction. Conversely, the attention aspect in the control class received the lowest score, namely 69%, with the lowest indicator being "attention to tasks." This condition shows that students did not pay optimal attention to tasks, which can directly reduce learning effectiveness. The research supports this finding by highlighting that student attention significantly affects learning outcomes. Observations during PBL learning in the control class revealed that, although the model is problem-based, its implementation is still dominated by teachers in directing learning activities. Limited interaction and minimal active involvement resulted in suboptimal student attention and motivation in completing tasks (Hidayati & Rodliyah, 2020).

Thus, it can be concluded that the application of the Discussion-Comparison with Critical Analysis and Learning Community Extended methods significantly increases student motivation for learning compared to schools that use PBL. The advantage of this method lies in its ability to create an interactive, relevant, and satisfying learning atmosphere for students, thereby encouraging active participation, emotional involvement, and consistency in learning in the biology learning process

Cognitive Learning Outcomes

In addition to reviewing learning motivation, this study also evaluated students' cognitive learning outcomes using pretest and posttest. A comparative summary of the average pretest, posttest, and N-Gain scores for both the experimental and control classes is presented in Table 5, clearly illustrating the improvement in students' cognitive learning outcomes after implementing the learning methods.

Table 5. Comparison of *Pretest*, *Posttest*, and N-Gain Scores of Students' Cognitive Learning Outcomes

Class	Mean Pretest Score	Mean Posttest Score	Mean N-Gain	Category
Experimental	33.85	83.08	0.7225	High
Control	40.45	47.77	0.1020	Low

Based on Table 5, student learning outcomes improved in both groups. The experimental class's average score increased from 33.85 to 83.08, while the control class's average score increased only from 40.45 to 47.77.

Furthermore, the effectiveness of the learning methods was evaluated using the N-Gain analysis, as presented in Table 5. The results show that the experimental class achieved a mean N-Gain of 0.7225, which is high, while the control class achieved a mean N-Gain of 0.1020, which is low. These findings indicate that the learning method used in the experimental class was more effective at improving students' cognitive learning outcomes than the conventional method used in the control class.

Before conducting the hypothesis test, the *posttest* data were first tested for normality and homogeneity to ensure the feasibility of the analysis. A summary of the results of both tests is shown in Table 6.

Table 6. Results of Normality and Homogeneity Tests of Students' *Posttest* Scores

Class	*Shapiro-Wilk*				*Test of Homogeneity of Variance*				
	Statistic	*Df*	*Sig*	Description	*Levene Statistic*	*df1*	*df2*	*Sig.*	Description
Experiment	0.910	30	0.015	Not Normal	1.135	1	58	0.291	Homogeneous
Control	0.955	30	0.234	Normal					

Based on Table 6, the normality test shows that the *posttest* data in the experimental class have a significance value of 0.015 (< 0.05), indicating that the data are not normally distributed. Meanwhile, the data from the control class had a p-value of 0.234 (> 0.05), indicating normality. Furthermore, the homogeneity test produced a significance value of 0.291 (> 0,05), so that the variance of the *posttest* data for both classes were homogeneous. Because one of the classes was not normally distributed even though the variance was homogeneous, the difference in learning outcomes was analyzed using the Mann-Whitney U nonparametric test, as shown in Table 7.

Table 7. Results of Nonparametric Test (*Mann-Whitney U Test*) of Students' *Posttest* Data

Cognitive learning outcomes	Mann-Whitney U	Z	Asymp.Sig.(2-tailed)
	0	-6.692	0.000

Based on Table 7, a significance value (Asymp. Sig. 2-tailed) of 0.000 was obtained, which is smaller than 0.05. This indicates a significant difference in *posttest* scores for cognitive learning outcomes between the experimental and control classes.

The study's results show that students who learn with this method achieve better cognitive learning outcomes than those who receive conventional instruction. This is evident in the increase in the average posttest score in the experimental class, which constitutes significant empirical evidence, and in the N-Gain value in the moderate to high category, indicating the effectiveness of both methods in improving understanding of ecosystem concepts. The advantage of this method lies in the learning steps that facilitate active student involvement. The learning process, which begins with the preparation of a critical analysis of the material, the presentation of group discussion results, comparison with other groups, and the provision of argumentative responses, can develop higher-order thinking skills such as understanding, application, and in-depth analysis. This process provides space for students to experience meaningful, reflective learning, as supported by research that emphasizes that structured discussions increase students' active participation and conceptual understanding through intensive group interaction.

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The application of the *Extended Learning Community* method adds a strong contextual dimension to learning. The presence of expert practitioners from the Bengkulu Province Environment Agency provided a direct presentation on waste management at the Bengkulu City Final Disposal Site, which clearly linked ecosystem concepts to local environmental issues. This activity enabled students to connect abstract biological concepts with authentic real-world problems, thereby facilitating deeper conceptual understanding (Silvana & Sumbawati, 2017). Moreover, interaction with practitioners through question-and-answer sessions enhanced students’ cognitive engagement, as they were required to analyze information, evaluate real cases, and formulate reasoned responses. These findings are consistent with Hutauruk et al. (2024), who reported that practitioner involvement in learning significantly increases students’ cognitive engagement and learning outcomes.

In addition, the *Discussion-Comparison with Critical Analysis* method plays a crucial role in improving students’ cognitive learning outcomes. Among the stages of this method, the critical analysis and group comparison stages were the most influential in developing students’ cognitive abilities. During the critical analysis stage, students analyzed learning materials and relevant articles by identifying key concepts, formulating questions, and providing tentative answers. This process directly trained higher-order cognitive skills, particularly analysis and evaluation, at the upper levels of Bloom’s taxonomy (C4–C5) (Irwandi & Hasan, 2021; Lawless & Chen, 2019)

Furthermore, the comparison stage, in which presenting groups received feedback from comparator groups, encouraged students to defend arguments, revise misconceptions, and synthesize multiple perspectives. This stage fostered deeper cognitive processing and conceptual restructuring, which are essential for meaningful learning (Irwandi, 2020). When combined with the *Extended Learning Community* approach, these stages became more effective, as students could validate classroom discussions with real-world experiences shared by practitioners. Therefore, integrating critical discussion, comparative argumentation, and practitioner involvement creates a learning environment that strongly supports the development of students’ cognitive learning outcomes.

This significant difference shows that this method effectively improves students' cognitive learning outcomes compared to conventional methods. Overall, the use of these two methods not only enhances conceptual understanding through critical thinking and discussion but also enables more meaningful learning by providing a relevant, collaborative context. Thus, this study confirms that learning that integrates critical discussion strategies and involves field practitioners can significantly enhance students' deep understanding, analytical skills, and learning motivation, ultimately improving their cognitive learning outcomes.

CONCLUSION

The application of Discussion-Comparison with Critical Analysis and Learning Community Extended proved more effective than conventional methods, increasing student motivation and cognitive learning outcomes through critical discussion and practitioner involvement. Teachers are advised to apply this method continuously with the support of the school, while further research can test other materials, levels, or variables for more comprehensive results.

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