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The critical thinking skills and independent learning analysis: The flipped classroom based on blended learning

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ABSTRACT

The results of observations in the Biology Education Study Program of Sembilanbelas November Kolaka University, until now the lecture activities carried out in general still use the conventional model which causes students to tend to be passive, the low independence of student learning which hinders students' thinking skills. For this reason, an innovative lecture model is needed that can develop and improve students' critical thinking skills and independence. The purpose of this study was to determine the critical thinking skills and independent learning of students through the flipped classroom model based on blended learning. This research is a quasi-experimental research using one group pretest-posttest design. Data collection by tests and questionnaires. Data were analyzed descriptively quantitatively and one sample t test. The results showed that the value of critical thinking skills of paired samples t-test obtained a significance level (p) of 0.00 < 0.05. For independent learning as a whole, the results of the paired samples t-test obtained a significance level (p) of 0.00 < 0.05. So it can be concluded that students' critical thinking skills and independence are better when applying the blended learning-based flipped classroom model.

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INTRODUCTION

Critical thinking skills are one of the skills needed in the 21st century. Every individual must continue to make decisions, solve problems and obtain various types of information throughout their lives (Supriyati et al., 2018). When making decisions, the individual requires critical thinking so as to be able to find the best solution to a problem (Narayanti, 2017) (Sari et al., 2021). Critical thinking skills are important for every individual to make wise decisions in the face of increasingly complex 21st century challenges (Maolidah et al., 2017) (Inayah et al., 2021). Therefore, teachers and lecturers are responsible for developing and improving these skills through implementation in learning, including in the Biology Education Study Program of USN Kolaka. Based on observations, until now the lecture activities designed and implemented in general still use

conventional methods which cause students to tend to be passive and lack of interaction during lectures. This of course hampers students' critical thinking skills. For this reason, a lecture model is needed that can develop and improve students' critical thinking skills by paying attention to post-pandemic conditions.

Entering the new normal period, face-to-face learning has been carried out although it is still limited considering that the pandemic has not completely ended, so in the era of digital technology, blended learning-based learning is considered appropriate for the current learning process (Aini, 2021), namely learning that combines face-to-face and face-to-face learning. online, where by utilizing technology, learning can occur anytime and anywhere with gadgets and internet access (Ratna et al., 2019). However, of course, student learning independence is needed in this study. Independence in learning is a must in today's education, this is in accordance with the Presidential Regulation of the Republic of Indonesia No. 87 of 2017 concerning strengthening character education. In addition, it is also needed in the new normal era, where it is necessary to develop students' abilities to carry out a learning process that does not depend on lecturers, friends, the environment and others. It is hoped that the initiative and responsibility of students will play an active role in learning planning, learning processes and learning evaluations (Nurur, 2021). The greater the role of students in these various activities, the students have a high level of learning independence (Fahmy, 2019).

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The blended learning model of the flipped classroom is an innovative, more active, learner-centered and more interesting learning model, so if it is designed properly it is very supportive to develop students' critical thinking skills (Nurhayati et al., 2019). In addition, in this learning, students will be trained and accustomed to studying material independently and able to work together to solve problems independently (Widodo et al., 2021). In Flipped Classroom learning, students are required to be more independent because they study the material first before meeting in class (asynchronous). This model also encourages students to be more active and critical because their curiosity is also higher. (Ahmad, 2021) (Kadry & Hami, 2014). Students can control their own pace, progress and responsibility in the learning process based on their own needs. While lecturers can make meaningful contact with students to observe, guide, comment, and help (Aini, 2021) and (Cheung, 2018). This model is also considered to be very supportive of constructivists in education in the 21st century which concerns how meaning and knowledge are created and constructed by each individual, and how to share meaning and knowledge in social groupings in the classroom (Cheung, 2018) and (Andrini, V S, Primary, H, 2019).

The flipped classroom learning model based on Blended learning (learning that combines online and face-to-face) is considered appropriate and necessary in learning in the era of the

industrial revolution 4.0, because technological advances provide many opportunities for students to access information sources in digital form for learning subject matter content (Hendrik et al., 2021). The use of technology in flipped classroom learning supports learning materials that can be accessed anytime and anywhere, while class time is used by students to collaborate with their peers, practice skills, and receive feedback on their progress (Andriyani & Suhendri, 2019). Thus, the blended learning-based flipped classroom model provides many opportunities to develop and improve 21st century skills, including students' critical thinking skills, as well as provide many opportunities for students to study independently (Kurniawati et al., 2019).

Previous studies that have become references and comparisons in conducting this research include: (Cheung, 2018), (Bishop et al., 2013), (Tanner & Scott, 2015), (Sajid et al., 2016), (Papalexiou et al., ., 2017), (Mahalli et al., 2019), (Hasanudin et al., 2020), and (Rusnawati, 2020). These studies show that flipped classrooms and blended learning have been widely practiced and in general it can be stated that the blended learning-based flipped classroom model has a positive impact and response, students are actively involved in learning activities, the level of understanding, independence, and motivation to learn is higher, and can support the development of critical thinking skills. However, further research is needed on the impact in detail and objectively with a more in-depth analysis of critical thinking skills and student learning independence, especially after the pandemic (new normal era).

Based on this description, the purpose of conducting this research is to determine the critical thinking skills and learning independence of students of the biology education study program through the application of the blended learning-based flipped classroom model in the post-Covid-19 pandemic (new normal period). This research is considered urgent to be carried out as a solution to face challenges in the new normal and in the future through the field of education/learning by applying science and technology.

RESEARCH METHODS

Research Design

This research is a quantitative research with a quasi-experimental approach and uses a one group pretest-posttest design. In this design an experimental class is used, which is first given an initial ability test (pre-test), then given treatment, namely the application of a blended learning-based flipped classroom model, and finally, students are given a learning independence questionnaire and a critical thinking skills test (post-test).

Table 1. One group pretest-posttest design

Pretest	Treatment	Posttest
O_1	X	O_2

Information:
O1 = Pre-test
X = Treatment (application of blended learning-based flipped classroom model)
O2 = Post-test.

Population and Samples

The population in this study were students of the Biology Education Study Program at the USN Kolaka Academic Year 2021/2022, totaling 130 people. The sampling technique used the non-probability sampling method with purposive sampling technique and the class of 2020 was selected as the experimental group with a total of 17 students who would be treated in the form of lecture activities with a blended learning-based flipped classroom model.

Instruments

The data collection techniques and instruments used in this study consisted of: 1) Data on students' critical thinking skills in the form of student achievement scores obtained from the pre-test and post-test given in the form of essay questions, where each item of the question was adjusted to the indicators. The pretest and posttest have 5 essay questions with the indicators of critical thinking skills: elementary clarification, the bases for the decision, inference, advanced clarification, supposition and integrationstudents' critical thinking skills that are validated and revised according to input or suggestions from the validator, and 2) Learning independence questionnaires are a number of statements that must be answered by students according to the indicators of student learning independence which are also validated and revised according to suggestions from the validator. Questionnaire scores using a Likert scale.

Data Analysis

Data on the results of critical thinking skills and student learning independence were analyzed quantitatively descriptive statistics by presenting the data, calculating the total score for each indicator, the percentage of answers for each indicator and then concluding the data in accordance with the provisions of the percentage scale. While the statistical inferential analysis using the one sample t test with the IBM SPSS Statisctic 20 program.

RESULTS

Student Critical Thinking Skills

The results of the descriptive analysis of students' critical thinking skills data through an essay test given at the beginning of the study (pre test), namely before applying the blended learning-based flipped classroom learning model and which was given at the end of the study (post test), namely after applying the blended learning-based flipped classroom learning model each is presented in Table 1.

Table 2. Data on Students' Critical Thinking Skills Before and After Treatment (Post Test)

No.	Value Interval	Catagory	Before Treatment		After Treatment	
			Frequency	Percentage	Frequency	Percentage
1.	81,25 – 100	Very high	0	0 %	5	29,41 %
2.	71,50 – 81,24	High	0	0 %	8	47,06 %
3.	62,50 – 71,49	Medium	3	17,65 %	4	23,54 %
4.	43,75 – 62,50	Low	13	76,47 %	0	0 %
5	0 – 43,75	Very low	1	5,88 %	0	0 %
	Total		17	100	17	100

Furthermore, based on the results of the analysis with Shapiro-Wilk, for the normality test, a significance value (p) before treatment (pre test) was 0.57 ($p > 0.05$) and after treatment (post test) was 0.60 ($p > 0$). 0.05), so it can be stated that the results of the pre-test and post-test are normally distributed. Furthermore, the average difference test (paired samples t-test) obtained a significance level (p) of 0.00 which is smaller than 0.05 ($p < 0.05$) meaning that there are differences in students' critical thinking skills before and after applying the flipped learning model.

classroom based on blended learning. Where students' critical thinking skills are better after applying the flipped classroom learning model based on blended learning in learning/lectures.

Student Learning Independence

Based on the student learning independence questionnaire scores obtained before applying the blended learning-based flipped classroom model and after applying the blended learning-based flipped classroom learning model, respectively, they are presented in Table 2 and Figure 1.

Table 3. Results of Student Learning Independence Questionnaire Analysis

No.	Indicator	Question	Before Treatment		After Treatment	
			Score	Percentage	Score	Percentage
I	Don't depend on other people	I am not able to complete my coursework on my own without the help of others.	34	50%	53	77,94%
		I improve learning achievement because of encouragement from others.	33	48,5%	45	66,18%
		I chose the right learning strategy for myself.	33	49%	47	69,12%
		I am able to deal with learning problems that are faced by myself.	34	50%	43	63,24%
	Average value			49,26%		69,12%
	Catagory			Enough		Very good
2	Self-confident	I believe and believe that I can achieve my learning goals.	32	47,1%	48	70,59%
		I dare not express an opinion that differs from the opinion of others.	35	51%	43	63,24%
		I believe that I am able to overcome the problems/difficulties that I face in my learning activities.	29	42,6%	42	61,76%
	Average value			47,06%		65,20%
	Catagory			Enough		Very good
3	Diciplin	I plan my learning activities	32	47,1%	43	63,24%
		I always collect assignments	29	42,6%	44	64,71%
		lectures on time.	30	44%	44	64,71%
	Average value			44,61%		64,22%
	Catagory			Enough		Good
4	Responsibility	I try to carry out my study plan as best as possible.	27	40%	42	61,76%
		I am not able to focus my attention in lecture activities.	31	46%	43	63,24%
		I push myself to continue to be passionate about learning.	31	46%	39	57,35%

	Average value			43,63%		60,78%
	Catagory			Enough		Good
5	Own initiative.	I will not express opinions/ideas without being asked	29	43%	47	69,12%
		I work on practice questions, although not as a lecture assignment.	26	38,2%	41	60,29%
		I will not study the course material until asked	23	33,8%	44	64,71%
		I plan my own learning activities.	26	38,2%	36	52,94%
	Average value			38,24%		61,76%
	Catagory			Enough		good
6	Exercise self control.	I believe that my learning activities ultimately have an impact on me.	26	38,2%	47	69,12%
		I do not evaluate my learning outcomes.	25	37%	41	60,29%
		I pay attention to the increase and decrease in learning outcomes that I get.	29	43%	38	55,88%
	Average value			39,22%		61,76%
	Catagory			Enough		Good
	Average score and category of student learning independence			43,67% (enough)		63,81% (good)

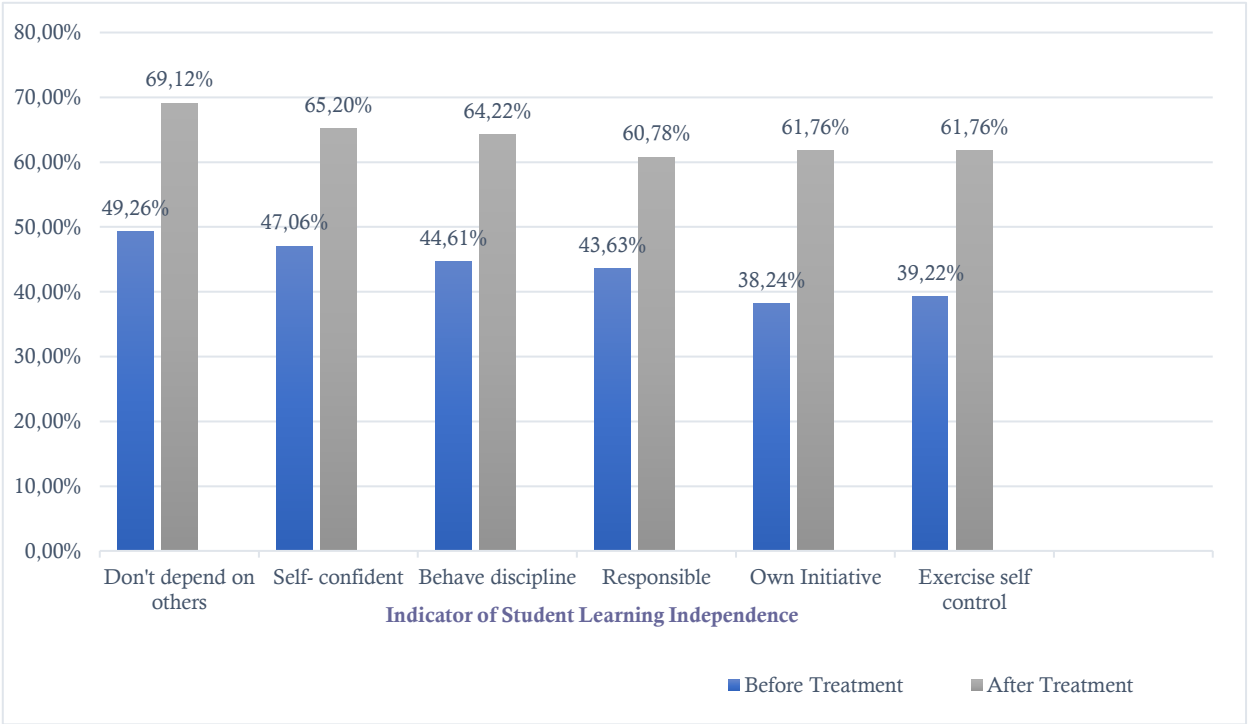

Figure 1. Comparison of Student Learning Independence Before and After Treatment

Furthermore, the results of the analysis with Shapiro-Wilk, for the normality test obtained a significance value (p) before treatment of 0.09 (p> 0.05) and after treatment of 0.247 (p> 0.05), so it can be stated that the data before treatment and after the treatment was normally distributed. Furthermore, the average difference test (paired samples t-test) obtained a significance level (p) of 0.00 which is smaller than 0.00 (p <0.05) meaning that there is a difference in student independence before and after applying the flipped classroom-based learning model. blended learning. Where student independence is better when applying the flipped classroom learning model based on blended learning in learning/lectures.

DISCUSSION

Based on the research results, it is known that students' critical thinking skills and independence are better when the blended learning-based flipped classroom is applied in learning/lectures compared to conventional models. Students who were sampled in this study were previously accustomed to conventional methods, which usually spent most of their time learning from lectures and questions and answers given by lecturers in class, then doing assignments and solving problems at home. Meanwhile, during the research, applying the blended learning-based flipped classroom model, which is also known as the reverse classroom method, changed the role of the tasks performed in class and at home. Knowledge or course material is shared online for students to study at home before class sessions (asynchronously). Later in class, students interact with lecturers and colleagues to discuss topics, clarify open-ended questions, and complete assignments (synchronous).

During lectures with this model, students are given the opportunity to read the material that will be discussed in class before class meetings, they must prepare before class, they can choose when they study and use digital technology to access more resources related to the material being studied. Furthermore, interaction in class both in real time in class and online (eg zoom and google meet) with lecturers and classmates and receive feedback at the same time. Thus they will try to understand the material given, think reflectively and try to make judgments to be able to decide what information is reliable and what actions should be taken during reasoning and problem solving. This means that with a blended learning-based flipped classroom learning model, students' critical thinking skills will develop by studying complex subject matter for a deep understanding of concepts and principles. This can be seen from the data on students' critical thinking skills using the conventional model (pre test) with an average value of 52.9 (low category) and after applying the blended learning-based flipped classroom learning model, the average value of students' critical thinking skills is 77.4 (high category). In addition, the results of the average difference test (paired samples t-test) obtained a significance level (p) of 0.00 which is smaller than 0.05 (p < 0.05), which means that there are differences in students' critical thinking skills before and after apply the flipped classroom learning model based on blended learning. Where students' critical thinking skills are better after applying the blended learning-based flipped classroom learning model.

The results of the analysis prove that the tasks given to students require them to process information correctly from various sources and then critically assimilate the information for knowledge construction. This is in line with Cheung (2018), that with a reverse classroom strategy which shifts the delivery of teacher knowledge outside formal class time and uses formal class time for students to be actively involved in knowledge construction through extensive interaction with peers and teachers, it has the potential to encourage and develop critical thinking skills through everyday learning in the classroom. Critical thinking skills are one of the 21st century skills that are very important to have, (Supriyati et al., 2018) states that someone who has critical thinking skills will be able to identify problems, ask questions to solve problems, convey arguments and find other

information needed. to solve the problem. Furthermore (Rokhmania & Kustijono, 2017), states that individuals with ideal critical thinking tend to try to understand a problem clearly, to "fix it," to find the truth, and to present a problem honestly and clearly, have the ability to clarify, to seek and judge well the basis for a view, to infer wisely from the base, and to think and integrate imaginatively.

Student success, including in improving critical thinking skills is not determined solely by knowledge and technical abilities, but rather by the ability to manage oneself and others (soft skills). One of the important soft skills for students to have is independent learning. Independent learning students are individuals who are actively involved in the learning environment, manage to train, and use their abilities effectively, and have positive motivational beliefs about their abilities in learning (Fahmy, 2019). The absence of independent learning in students will result in various behavioral problems, such as shyness, lack of school motivation, and poor study habits. Students who have high learning independence will have better learning abilities and results. The flipped classroom model based on blended learning is learning where students will not spend a lot of time listening to long lectures in class, but will have more time to solve problems individually or collaboratively through distance learning. In learning, students can control their own learning steps, and are responsible for the learning process, so that student learning independence can be increased (Kurniasih & Muchlis, 2021).

The results of the data analysis of student learning independence which consisted of six indicators in this study, showed that student learning independence when the blended learning-based flipped classroom model was applied was better than before it was applied or with conventional learning models, including: indicators not depending on others and attitudes confidence with the conventional learning model is in the moderate category (49.26% and 48.06% respectively) while the blended learning-based flipped classroom model is in the very good category (69.12% and 65.20% respectively), then for the indicators of being disciplined, responsible, self-initiative, and exercising self-control with conventional learning models, each of which is in the sufficient category (with the percentages of 44.61%, 43.63%, 38.24%, and 39.22%), while the blended learning-based flipped classroom model is in category b good (with percentages 64.22%, 60.78%, 61.76%, and 61.76%, respectively). Meanwhile, the overall level of student learning independence before being applied or using the conventional learning model was in the sufficient category (43.67%) and when the blended learning-based flipped classroom model was applied it was in the good category (63.81%).

Furthermore, the results of the analysis with the average difference test (paired samples t-test) obtained a significance level (p) of 0.00 which is smaller than 0.00 ($p < 0.05$), which means that there are differences in student independence before and after applying the model. flipped classroom learning based on blended learning. Where student independence is better when applying the blended learning-based flipped classroom learning model.

The results of this study indicate that the flipped classroom model is based on blended learning which in its implementation provides opportunities for students to study subject matter at home by reading and understanding modules, books, and observing learning videos given before they come to class, and vice versa. -Group assignments, which are usually done at home, are completed in class by increasing collaboration with other students and with lecturers. Activities in the classroom through face-to-face learning (offline) and online through googlemeet which are filled with discussions and exchanging experiences. In such conditions, they must have their own initiative and intrinsic motivation, analyze needs, and formulate goals, select and implement problem-solving strategies, select relevant sources, and evaluate themselves. So that students become more independent in their learning activities, they are required to be more active/try to understand the material and solve problems independently and help students work on challenging projects.

This result is supported by the results of Widodo's (2021) research, where with the flipped classroom, students' learning independence becomes good, students look more prepared in learning, active student involvement in the implementation of learning with problem solving makes students more independent in working on problems (Sudiana & Fatah, 2017). The flipped classroom learning model can be an effective learning model to test students' creative attitudes, responsibility, and learning skills. This is also in line with research (Sajid et al., 2016) which concluded that the flipped classroom encourages independent learning and increases student engagement in the classroom, thus going beyond the traditional lecture method which is considered to make students passive and less independent in learning.

During blended learning-based flipped classroom learning, the lecturer as the teacher organizes, directs, and makes connections between activities in the classroom and outside the classroom; provide appropriate and detailed guidance, providing sufficient time for students to complete assignments; facilitate the formation of easy learning, provide rapid feedback on individual or team assignments, and increase the effectiveness and efficiency of learning with user-friendly technology. In addition, online lectures in blended learning) allow students to set their own pace individually and remove time and location barriers. Reverse classes facilitate productive discussion and increase student interaction during valuable class time, increasing their ability to reason and apply learned information. The results obtained show that the blended learning-based flipped classroom model combines synchronous learning with asynchronous independent learning, students will be more independent because they study the material first before meeting in class and also encourage students to be more active and critical. because their curiosity drive is also higher.

CONCLUSION

Based on data analysis both descriptively quantitatively and inferential statistics as well as discussion of the results, it can be concluded that students' critical thinking skills and independent learning are significantly (p) 0,00 ($p < 0,05$) better by applying the flipped classroom model based on blended learning in learning/lectures. However, it is recommended for further researchers to use different instruments to see the effect of the blended learning-based flipped classroom model. In addition, it is also possible to develop appropriate teaching materials/learning media for the implementation of the blended learning-based flipped classroom model in the future.

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