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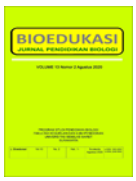

Implementation of Blended Learning to Improve Critical Thinking Skills and Motivation

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ABSTRACT

The aims of this research are to 1) know the differences of Critical Thinking Skills from blended learning in Diversity dan Classification of Invertebrate course, 2) find out the result of the blended learning implementation concerning study motivation in Diversity dan Classification of Invertebrate course at Biology Education program, 3) know the effect of blended learning on critical thinking in solving problems. Blended learning-based learning is a combination of face-to-face and online learning. Online learning is learning through various learning facilities such as using material sharing via PowerPoint, WAG, email, recitation of downloading material from various journals without the need for a face-to-face meeting. The research subject were students of the second-semester Biology education program. Data collection on critical thinking skills was taken from test scores after learning eight times, learning motivation data was taken through a questionnaire. Different test analyses using One Way ANOVA with a prerequisite test consist of normality test (Saphiro-Wilk Test) and homogeneity with Levene Test. The questionnaire analysis uses Rasch analysis with the help of Winsteps version 4.6. From the results of the study, it can be concluded that 1) there is a significant difference in critical thinking skills in blended learning and online learning, 2) there is a difference in learning motivation from blended learning and online learning, 3) there is a positive effect on critical thinking skills in solving problems given in blended learning.

Keywords: Blended Learning, Online Learning, Critical Thinking Skills, Motivation

INTRODUCTION

Blended learning is learning that is supported by an effective combination of different modes of delivery, teaching, and learning styles and is found in open communication between all parties involved with training. Today, we have entered a period known as the knowledge age. The trend of learning has changed from the traditional learning approach towards future learning, known as the learning age of knowledge. The characteristics of learning in the age of knowledge, namely: lecturers as facilitators, mentors, and consultants, lecturers as study partners, learning is directed by the learner, learning openly, flexible as needed. Not only that the advantages of using blended learning as a combination of direct teaching (face to face) and online teaching, but also as an element of social interaction. The development of education today is influenced by the rapid progress of information and communication technology. One of the information technologies that play a role in the world of education is online learning. Online learning serves as a liaison between educators and students inside an internet network could be accessed anytime and anywhere. The online media used by the research subjects are various (WhatsApp, Google Classroom, Website). Submission of material online can be interactive so that learning participants can interact with computers as learning media. One example of students who use electronic media learning or establish relationships (browsing, chat, video call) through electronic media, computers, and the internet will later obtain more effective and better learning outcomes than conventional learning. The essence of the learning outcomes of today's Invertebrate Diversity and Classification.

Courses in universities are that there must be changes in students' critical thinking aspects. In this Diversity dan Classification of Invertebrate learning, more problems must be discussed, solutions are sought, and humans can behave as part of the environment. Learning is more directed at the student, thus learning students can find problems and solve solutions. The approach used in this Diversity dan Classification of Invertebrate learning is Project-Based Learning (PBL) which trains students to solve problems. In learning, lecturers and students as academics in the development of science are more discourses. According to Synder and Mark in Manshaee, et al. (2014), critical thinking skills are one part of the 21st century skills that can encourage students to overcome scientific, social, and practical problems in the future. The ability to think critically has an important role in the world of education and is the main goal in learning because it can help students master the content of each subject and be able to apply it in everyday life. Harris (in Meng-Lei Hu, 2004) states that one of the important factors in achieving academic achievement is motivation.

METHODS

The research was conducted at Biology Education Programs, the Faculty of Teacher Training and Education, Sebelas Maret University. The following are the procedures done in the research:

Preliminary Planning: The planning process begins with making RPS (Semester Learning Plans) for Invertebrate Diversity and Classification course learning tools and material planning. Lecture scenarios were also made in the planning process. Arrangements for online learning using smart, via email, and chat groups. Blended learning by combining face-to-face with online is considered very useful to be carried out cooperatively.

Development Process: Blended learning is conducted eight times to mid-semester, while online learning is conducted at the 9th to 16th meetings. Critical thinking skills tests and motivational questionnaires are given after each lesson is given. The target of the development stage is to increase critical thinking skills and provide strong motivation in blended learning. The development of combined face-to-face and online lecture materials will be carried out by

providing blended learning multimedia facilities. The choice of delivery method is in the form of ppt slides, videos, animations, texts, and interactive media, which are tailored to the topics of the courses to be explained. Lecturers can deliver lecture material with a problem-based learning approach, and of course, involve students actively. The approach is made with the aim that students have a spirit of independence in learning, and if possible, it is attempted to foster creativity so that they can make innovations. This learning strategy is called the Active Learning Strategy. The steps in the development activities that will be carried out are as follows:

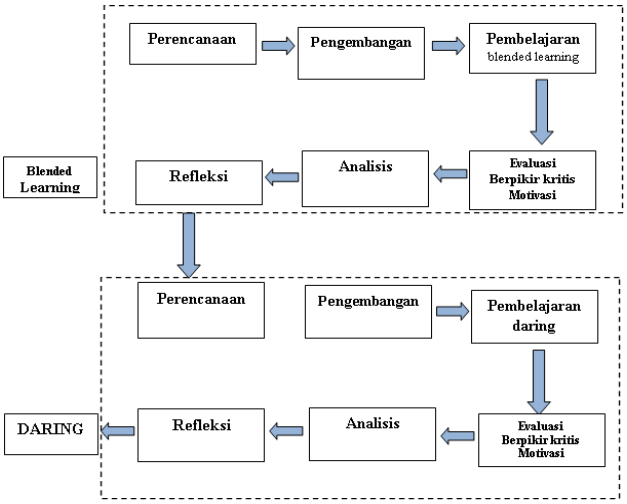

Figure 1. Activity Steps

Analysis stage: Significance tests were carried out using One Way Anova with prerequisite tests in normality test (Shapiro-Wilk) and homogeneity (Levene test).

The results of the questionnaire were analyzed using Rasch analysis with the help of Winsteps version 4.6. A DIF (Differential Item Functioning) analysis was carried out using Winsteps version 4.6 software to find out the comparison of student learning motivation in blended and online learning.

RESULTS AND DISCUSSION

Comparison of Critical Thinking Skills in Online and Blended Learning. Students in the Invertebrate Diversity course are given two types of learning activities in this research activity: online and blended learning. The results of students' critical thinking skills test results in these two types of learning activities are presented in Table 1.

Table 1. Comparison of the average achievement of student's critical thinking skills

No	Class	Average Achievement of Student's Critical Thinking Skills	
		Online	Blended
1	A	82.27	85.31
2	B	80.67	86.58
3	C	83.39	85.89

The critical thinking skills test results in Table 1 show that when blended learning is carried out, students generally get higher achievements than when the test is given during

online learning. The graph of critical thinking skills test achievement in the three classes is presented in Figure 2.

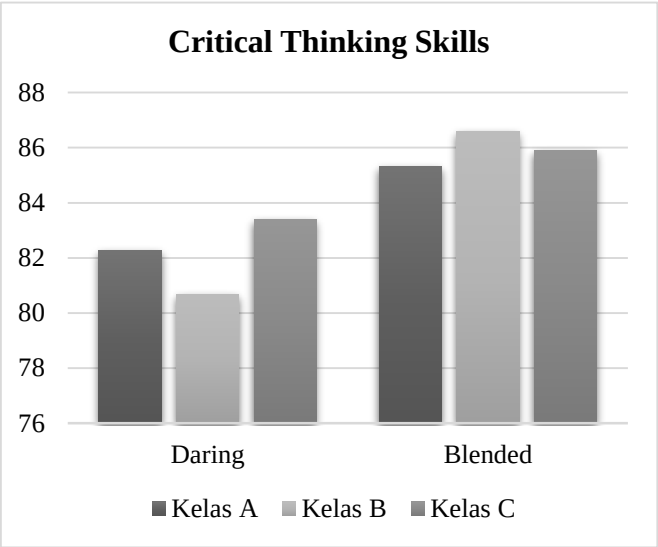

Figure 2. Comparison of critical thinking skills in online and blended learning

A significance test was then conducted to determine whether there was a significant difference in the average achievement of critical thinking skills in the three online and blended learning classes. Significance tests were carried out using One Way ANOVA with prerequisite tests in the form of normality and homogeneity tests.

Table 2. Normality test results of critical thinking skills data

Class		Shapiro-Wilk		
		Statistics	df	Sig.
Blended	A	.953	26	.273
	B	.974	24	.759
	C	.943	28	.131
Online (*Daring*)	A	.972	26	.681
	B	.964	24	.534
	C	.969	28	.567

Table 3. Homogeneity test results of critical thinking skills data

	Levene Statistic	df1	Df2	Sig
Blended	0.57	2	75	.945
Online (*Daring*)	.191	2	75	.827

The normality and homogeneity test results showed that the data on critical thinking skills in blended and online learning were normal and homogeneous. These results indicate that the data meet the requirements for a different test with one-way ANOVA. The results of the test using One Way ANOVA are presented in Table 4 and Table 5.

Table 4. One Way Anova test results on blended learning

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	152.321	2	76.161	6.140	.056
Within Groups	800.050	75	10.667		
Total	952.372	77			

Table 5. One Way Anova test results on online learning

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	40.514	2	20.257	5.987	.006
Within Groups	508.666	75	6.782		
Total	549.179	77			

The results of the significance tests in Tables 2 and 3 show that blended learning tends to be more evenly distributed, marked by no significant difference between the three classes (Sig. > .05). In contrast, in online learning, the average achievement of thinking skills between classes tends to be unequal (sig. < .05).

Differences in Student Motivation in Online and Blended Learning. Student learning motivation in blended and online learning in this study was measured using a motivational questionnaire consisting of 30 question items with indicators: 1) desire and desire to succeed, 2) conducive learning environment, 3) future hopes or aspirations, 4) interesting activities in learning, 5) encouragement and needs in learning, and 6) rewards in learning. The results of the questionnaire were analyzed using Rasch analysis with the help of Winsteps version 4.6. The results of the student learning motivation questionnaire are presented in Tables 6 and 7

Table 6. Results of student learning motivation questionnaire on online learning

	Total Score	Count	Measure	Model S.E	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	78.6	30.0	.25	.28	1.00	-.25	1.00	-.25
SEM	.7	.0	.06	.00	.06	.23	.07	.24
P.SD	5.9	.0	.47	.01	.56	2.01	.57	2.03
S.SD	6.0	.0	.48	.01	.56	2.02	.58	2.04
MAX	100.0	30.0	2.08	.32	3.04	5.63	3.38	6.32
MIN	65.0	30.0	-.81	.28	.36	-3.52	.37	-3.47

Table 7. Results of student learning motivation questionnaire on blended learning

	Total Score	Count	Measure	Model S.E	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	81.5	30.0	.51	.29	1.00	-.35	1.01	-.34
SEM	.6	.0	.05	.00	.07	.26	.08	.26
P.SD	5.5	.0	.46	.01	.64	2.26	.69	2.28
S.SD	5.5	.0	.46	.01	.65	2.27	.69	2.29
MAX	100.0	30.0	2.16	.33	3.32	6.20	3.90	7.30
MIN	67.0	30.0	-.66	.28	.30	-4.05	.33	-3.82

The results of Rasch's analysis of motivation questionnaires in Tables 3.6 and 3.7 show that the Mean Measure achievement of blended learning is higher than online learning. Which is 0.51 logit compared to online with a logit Mean Measure value of 0.25, which indicates higher motivation during the learning process using the blended type of learning. These results indicate that students are motivated to participate in blended learning in Invertebrate Diversity and Classification courses. a DIF (Differential Item Functioning) analysis was performed using Winsteps software version 4.6 to determine the comparison of student motivation in blended and online learning. The results of the DIF analysis of student learning motivation are presented in Figure 3.

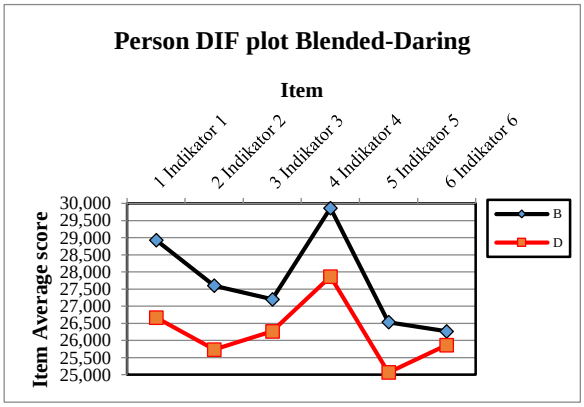

Figure 3. Results of Person DIF analysis on blended and online learning

The results of the DIF person analysis show that students' learning motivation in blended learning is higher than online learning on all indicators. The highest achievement indicator is on indicator four, namely activities that are interesting in learning. An analysis is carried out on each indicator To obtain more in-depth results regarding motivational achievement and presented in Table 8.

Table 8. Results of analysis of learning motivation questionnaire indicators in blended learning

Item	Total Score	Total Count	Measure	Model S.E.	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Indicator 6	197	77	.99	.28	.86	-1.29	.62	.53
Indicator 5	199	77	.83	.28	.96	-.29	.50	.52
Indicator 3	204	77	.44	.29	1.25	1.85	.41	.50
Indicator 2	207	77	.19	.29	.85	-1.05	.45	.49
Indicator 1	217	77	-.77	.33	1.03	.19	.49	.49
Indicator 4	224	77	-1.67	.39	1.08	.38	.62	.55
Mean	84.3	19.7	.00	.35	1.07	.2	1.00	.2

The Rasch analysis of the questionnaire items for each indicator in Table 3.8 shows indicator four that interesting activities in learning are the motivation indicators most agreed by respondents with the lowest logit value. On the other hand, the most disapproved

motivational indicator is indicator 6, namely the appreciation in learning with the highest logit value compared to other indicators.

The Influence of Learning Types on the Achievement of Critical Thinking Skills

A different test was conducted to test the differences in critical thinking skills in the two types of learning to determine the effect of the learning on the achievement of students' critical thinking skills. Before the difference test, a prerequisite test was carried out to determine the normality of the data distribution. The results of the normality test are presented in Table 9.

Table 9. Normality test results (Saphiro-Wilk Test)

	Type of Learning	Saphiro-Wilk		
		Statistic	**df**	**Sig.**
Critical Thinking Skills	Blended	.974	78	.118
	Daring	.974	80	.096

The normality test results show that the critical thinking achievement data in blended and online learning is normally distributed (Sig.> 0.05). Thus, the data meet the requirements for hypothesis testing, namely the difference test with the paired sample test to determine the significance of differences in the achievement of critical thinking skills in both types of learning. The different test results with the paired sample test in this study are presented in Table 10.

Table 10. Paired sample test result

	Mean	**SD**	**SE. Mean**	**95% Confidence Interval of the Difference**		**t**	**df**	**Sig. (2-tailed)**
				Lower	**Upper**			
Blended-Daring	2.079	2.692	.309	1.464	2.694	6.732	75	.013

The results of the different tests using the paired sample test in Table 10 show a significant difference (Sig. <0.05) between the achievement of students' critical thinking skills in blended and online learning. These results indicate an effect of the type of learning on students' critical thinking skills.

Critical Thinking Skills in Online and Blended Learning. The results showed that the achievement of students' critical thinking skills was higher in blended learning. The difference between blended learning and online learning includes several factors, namely differences in learning approaches, types of technology, and opportunities for students to collaborate directly with lecturers (Blass & Davis, 2003; Garrison & Anderson, 2003).

In the social aspect, lecturers have an important role in facilitating the learner-centered learning process (Bower, Hedberg, Kuswara, & Remi, 2010). During Invertebrate Diversity and Classification course, lecturers can encourage students to collaborate in blended learning. Lecturers can inspire students to express their opinions and observe and respond to other students' opinions. This offline discussion activity results caused the distribution of knowledge being evenly distributed among all students. In addition, online-based learning support will make discussions run more intensively than just using online learning without face-to-face. Several studies have shown the important role of the combination of face-to-face learning for collaboration with technology support (Biasutti, 2011; Bliuc, Ellis, Goodyear, & Piggott, 2011; de Smet, van Keer, de Wever, & Valcke, 2010; Hew & Cheung, 2008).

Student Learning Motivation in Online and Blended Learning. The high learning motivation of students is caused by the learning activities that are presented more interactively through

blended learning combined with problem-based learning so that students are motivated. Keller (2008) defines motivation as an innate characteristic possessed by students but is also influenced by external factors such as learning methods. In line with the results of this study, Yang et al. (2013) compared blended learning and offline learning. The results showed that blended learning motivated students to learn more.

Indicator 4 (interesting activities in learning) obtains the highest achievement or is most approved by students as the highest motivation in learning. Through the implementation of blended learning in Invertebrate Diversity and Classification courses, students experience various learning experiences. The implementation is in line with the research of Sidman, Fiala, & D'Abundo (2011), which found that diverse learning activities can make students motivated to take part in learning because they can arouse curiosity.

The positive impact of blended learning on motivation in the Invertebrate Diversity and Classification course is that students enjoy learning more. After all, they can use various facilities to access learning so that learning is no longer bound by quantity but rather leads to quality. Previous research has also indicated that blended learning can positively affect students' attitudes towards learning (Lei, 2010).

Problem-based learning and practicum applied in offline sessions in blended learning for the Invertebrate Diversity and Classification course positively impact student motivation. Students are given the freedom to find and explore new information. Through the problem-based learning syntax in this course, students can carry out cognitive and psychomotor activity-based learning through practicum-based learning. This learning is in line with Chao, Chen, & Chuang's (2015) research, which indicates a positive influence of cognitive and psychomotor activity-based learning on learning motivation. This research shows that there can be an interaction between intrinsic and extrinsic motivation in the learning process.

The Effect of Online and Blended Learning on Critical Thinking Skills and Student Learning Motivation. The results obtained in this study are not in line with previous research, which states that blended learning does not affect critical thinking skills (Akyuz & Samsa, 2009; Alotaibi, 2013). This effect is caused by differences in the learning characteristics carried out in this study with the previous research.

The blended learning in this study was carried out in the Invertebrate Diversity and Classification (IDC) course, which has problem-based learning and practicum characteristics. Blended learning in this IDC course can positively affect critical thinking skills compared to online-based learning because the nature of blended learning combines the flexibility of online learning, which allows students to study anytime and anywhere with offline learning so that students can discuss more freely. In addition, the combination of blended learning with problem-based learning can train students' higher-order thinking skills. Blended learning combined with problem-based learning has proven effective in improving students' analytical abilities (Belecina & Ocampo, 2016). Through problem-based learning, students can be trained to solve various problems through a scientific approach (Krishnan, Gabb, & Vale, 2011; Masek & Yamin, 2011). The application of blended learning in problem-based and practical IDC courses is also in line with the recommendation of Marra, Jonassen, Palmer, & Luft (2014) that problem-based learning can improve students' ability to build knowledge through scientific investigation. Practicing critical thinking skills by giving problems and then discussing them online allows students to understand the material better. This characteristic is in line with (Ennis, 2011), which states that critical thinking skills can be developed through a continuous clarification process through information seeking through a discussion process to conclude well.

The role of online discussion in the lectures is to provide a comfortable place for students to discuss during learning without being limited by space and time. The use of blended learning allows students to have more time to study and discuss one of the main advantages

of blended learning (Means et al., 2013). The advantages of blended learning are that it can overcome problem-based learning problems, which are generally constrained by its implementation, which takes a lot of time, so that it is difficult to apply offline learning at one time (Blackwell & Roseth, 2018).

The use of ICT is also known to positively impact the quality of the learning process (Ghavifekr & Rosdy, 2015). Students' critical thinking skills have also improved because students can do more problem analysis while looking for information during online discussions. This statement is in line with the research of Corso & Robinson (2013), which found that the use of internet assistance in learning activities can have a positive effect on thinking skills.

CONCLUSION

From the results of the research, it can be concluded: 1) there are significant differences in critical thinking skills in blended learning and online learning, 2) there are differences in learning motivation from blended learning and online learning, 3) there is a positive influence/ effect on critical thinking skills in solving problems given in blended learning.

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