



Project-based learning through edmodo: improving critical thinking and histology concepts

Fendy Hardian Permana*, Lise Chamisijatn

Biology Education, Universitas Muhammadiyah Malang, Indonesia.

*Corresponding author: fendy@umm.ac.id

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ABSTRACT

The results of the observation showed that there were still many students in histology subjects who did not yet have critical thinking competencies and maximum histology concept. The purpose of this study was to find out how project-based learning through blended learning can develop critical thinking skills and student histology concept. This type of research is classroom action research. The sample of this study was students of class C histology class 2018/2019 as many as 35 students of Malang Muhammadiyah University. The research method is in the form of observation, interviews, and tests. The learning management system used in this research blended learning uses Edmodo. The results showed that there was a change in the improvement of critical thinking skills and student histology concept from cycle I to cycle II. Critical thinking skills in the cycle I showed that 23% were complete and 77% were non-complete, while the cycle II was 80% complete and 20% non-compet. Critical thinking skills from cycle I to cycle II increased by 57%. Histology concept in the cycle I found 69% complete and 31% non-complete, while the cycle II was 100% complete and 0% non-complete. Histology concept from cycle I to cycle II increased by 31%. Based on this, project-based learning through blended learning can develop critical thinking skills and student histology concept.

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INTRODUCTION

The development of science, technology, and art gave rise to the era of industrial revolution 4.0. (Djamahar, Ristanto, Sartono, Ichsan, & Muhlisin, 2018; Mun et al., 2015) The era of the industrial revolution 4.0 was marked using technology in all human activities (Martin, Bohuslava, & Igor, 2018; Mourtzis, Vlachou, Dimitrakopoulos, & Zogopoulos, 2018). Human activities are



made easier and faster with the help of technology (Fitriani, Adisyahputra, & Komala, 2018; Rosamsi, Miarsyah, & Ristanto, 2019). Humans must now be able to master the technology that developed in this era of industrial revolution 4.0. Mastery of these technologies certainly requires competencies in humans. One of the competencies that must be fulfilled by humans is critical thinking. The ability to think critically about human beings does not directly appear to be possessed by humans; it is necessary to conduct training and habituation so that humans could think critically (Hokanson, 2018; Macke, 1991). Formal and informal education is one of the ways to develop human critical thinking skills. The design of learning activities in both formal and informal education is an essential key to being able to make education a place to develop human critical thinking skills.

The results of observations and evaluations to undergraduate students of the biology education, Universitas Muhammadiyah Malang in the Histology subject of the 2018/2019 academic year showed that many students did not yet have competencies in critical thinking. Based on the results of interviews conducted on students, information was obtained that the lecture activities that had been carried out were still not optimal in developing students' critical thinking skills. These problems must be resolved so that students have the competence to think critically.

Histology is a study of tissue structure related to using microscopes in detail on thin cut tissue (Roberts, Evans, Trivedi, & Menage, 2006). The histological concepts includes cell structure, epithelial tissue, glands, general connective tissue, special connective tissue, supporting tissue, muscle tissue, and nerve tissue (Junqueira & Carneiro, 2007). The purpose of students studying this histology course is so that students can understand more deeply the structure of the network. Based on the understanding of histology, it can be seen that in learning and mastering the concept of histology, critical thinking skills are needed. Critical thinking is required because, with essential students of thinking can observe in more detail the tissue preparation that has been cut thin.

The ability to think critically is a reflective mind that is focused on deciding what is believed to be done (Carter, Creedy, & Sidebotham, 2015; Reyes, 2017). Critical thinking is where one can analyze the underlying assumptions or opinions logically to sort out which information must be taken as correct information, not only that one must be able to convince his opinion to others (Yacoubian & Khishfe, 2018; Zori, 2016). Critical thinking based on expert opinion can be known that these competencies are very important for humans. Developing critical thinking skills in learning can be done by using the appropriate learning methods (Zubaidah, et al., 2018; Mahanal, Zubaidah, Sumiati, Sari., & Ismirawati, 2019; Noviyanti, Rusdi, & Ristanto, 2019).

Learning that is considered suitable in developing critical thinking skills is with project-based learning (Pratama, 2018). Project-based learning is learning that emphasizes student constructivism towards knowledge and skill to produce a product (Novita, Darmawijoyo, & Aisyah, 2016; Tsai, Shen, & Lin, 2015). Project-based learning is also learning that emphasizes student center activities and uses problems that exist in the surrounding environment (Allison, Gray, & Sproule, 2015; Lima, Dinis-Carvalho, Sousa, Arezes, & Mesquita, 2017). The results of Genc, (2015) research shows that there is an influence between project-based learning and critical thinking and histology concept.

Blended learning is learning that uses face-to-face and online activities. Blended learning enables students to study in school and continue learning at home with online activities (Best & Conceição, 2018; Lu et al., 2018). Blended learning makes students learn all the time (Diep, Zhu, Struyven, & Blicck, 2017; Henrie, Bodily, Manwaring, & Graham, 2015). The results of Auster, (2016) research shows that there is an influence between project-based learning and critical thinking and histology concept.

Based on this, learning activities that can develop critical thinking skills and histology concept are using project-based learning through blended learning. The renewal of this study compared with previous studies is that in this study combining project-based learning through blended learning to develop critical thinking skills and student histology concept. Based on this, research with blended learning implementation of project-based learning is done to improve critical

thinking abilities and histology concept. The purpose of this study was to determine blended learning implementation of project-based learning to improve critical thinking abilities and histology concept.

METHOD

Design of the Study

This type of research is classroom action research (CAR). Kemmis & McTaggart (1995) states that CAR is a dynamic process of four aspects, namely planning, action, observation, and reflection. The planning stage is the stage of planning action based on problems. The action stage is the process of the realization of learning activities in the classroom. The observation stage is the stage of conducting observation activities from activities. Reflection stage is an activity considering the results that have been obtained from the activity. The implementation of CAR is carried out by cycles of planning, implementation, observation, and reflection. This research was conducted at the Undergraduate Education and Biology Faculty undergraduate study program at the University of Muhammadiyah Malang for students in class c learning strategies. The online blended learning activity uses the learning management system in Edmodo. This class action research model can be seen in Figure 1.

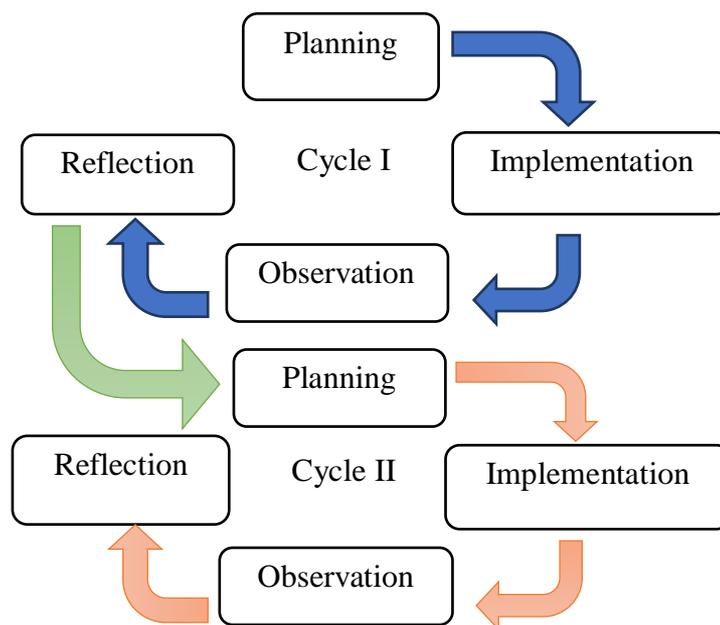


Figure 1. Research Model (Kemmis and McTaggart).

Procedure

This research is blended learning research, wherein learning activities there are face-to-face activities in class and online activities in each student's home. In this research activity, the emphasis is on measuring critical thinking skills and understanding histological concepts in students. To be able to make these measurements, the blended learning activities use the syntax of project-based learning activities, because project-based learning activities based on the results of previous studies can develop critical thinking skills. The novelty in this study compared with previous research is that in this study the use of project-based learning methods to measure critical thinking skills and understanding students' concepts has been combined with e-learning activities so that learning activities are felt more effective because students can study anywhere and anytime. The syntax of this learning activity is basically to implement project-based learning activities during class (face to face) learning and online (distance) learning. The steps of the learning phase in this study are 6 phases (Table 1).

Table 1.

The steps of the learning phase in this study.

Phase	Description
1	Phase 1 is the determination of fundamental questions. In this phase, the lecturer gives problems related to the material to be learned to students; this phase activity is carried out during learning in the classroom.
2	Phase 2 is designing project planning. In this phase, students design a project that will be created to solve problems that have been submitted by the lecturer in phase 1. The activities of this phase are carried out during learning in the classroom.
3	Phase 3 is compiling a schedule. In this phase, students arrange a timeline of how the project development process so that the results can be completed in time. This phase activity is carried out during learning in the classroom.
4	Phase 4 is an observation of students and project progress. In this phase, the lecturer observes the development of the project that has been done by students. This monitoring activity is carried out online using Edmodo, where students will report on what has been done.
5	Phase 5 is assessment. In this phase, the lecturer evaluates the projects that have been done by students. This assessment activity is carried out through online activities using Edmodo.
6	Phase 6 is a reflection and new findings. In this phase, a test is conducted on students. The test for students is done online using Edmodo. This test also aims to measure whether the project that has been done by students has answered problems discussed in the learning activities.

Participant

This study involved one lecturer as the primary researcher and one observer lecturer from the biology education study program at the University of Muhammadiyah Malang. The sample of this study were 35 class C students who attended the histology course. The research sample was class C students because, in this class, students were familiar with Edmodo. Students already familiar with Edmodo will make research activities more helpful because researchers do not need to explain how to use Edmodo from the beginning. Besides, this class C sample was chosen because I taught in the class so that learning management activities would be easier.

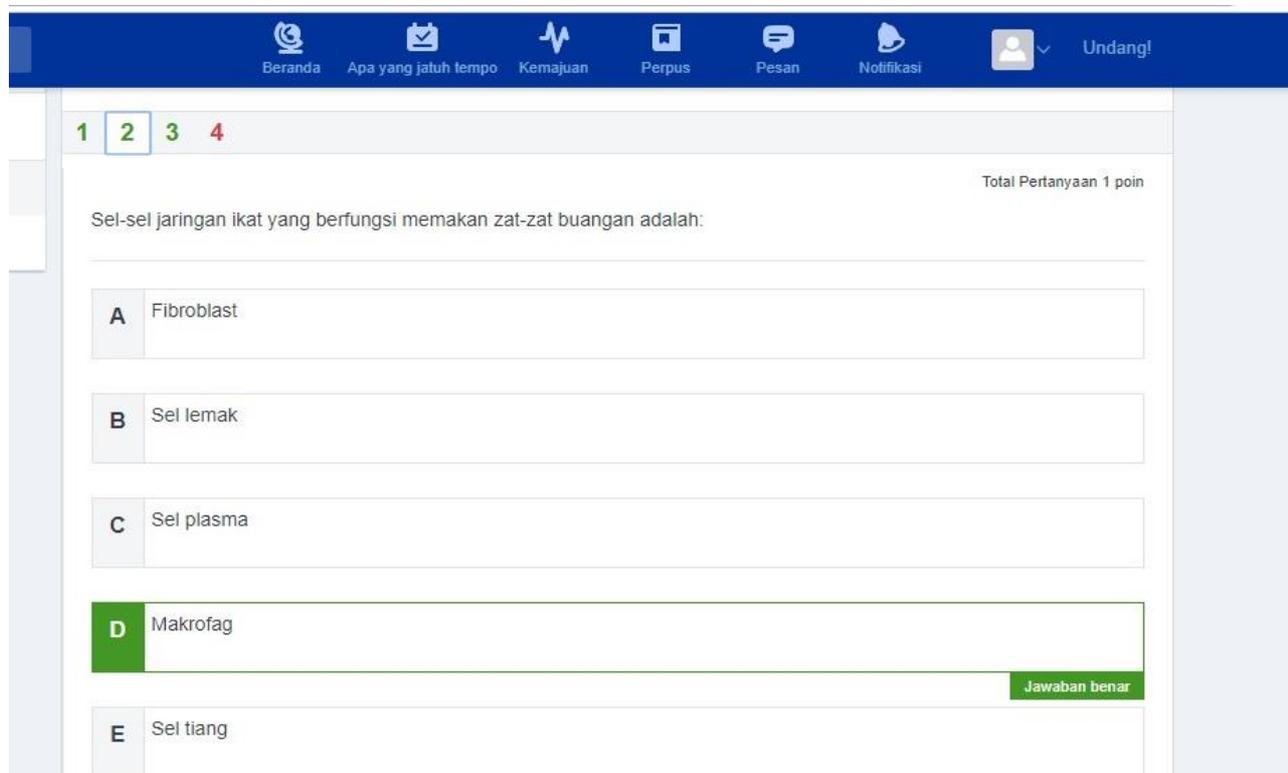


Figure 2. Online tests using Edmodo.

Instrument

The material in the histology lecture used in this study was about epithelium and tissue. The instruments used in this study were using student activity observation sheets, and critical thinking observation sheets refer to Permana & Setyawan, (2019), teacher activity observation sheets, pretest and posttest questions refer to Permana, (2015). Critical thinking data is obtained from critical thinking observation sheets during classroom learning activities. Critical thinking data when Edmodo learning activities are obtained from the online question and answer discussion activities. Histology concept data both when classroom and online learning activities are obtained from the pretest and posttest scores. Sample questions used in online tests using Edmodo to measure the ability of students' histology concepts can be seen in Figure 2.

Critical thinking is thinking in terms of checking, connecting, and evaluating all aspects of a situation or problem. Indicators of critical thinking in students include 1) giving a simple explanation, 2) building basic skills, 3) concluding, 4) giving further explanation, 5) arranging strategies and techniques (Ennis, 1985). An example of an indicator of the development of critical thinking can be seen in Table 2.

Table 2.

Indicator of the development of critical thinking.

No	Indicator	Description	Implementation	
			Yes	No
1	Giving a simple explanation	Focusing questions Analyze arguments Ask and answer the question about explanations and challenges		
2	Building basic skills	Consider credibility a source Observe and consider observation report		
3	Concluding	Make deductions and results consideration of deduction results Make induction and consider the results of induction. Make and consider value of decision.		
4	Make an explanation further (advance clarification)	Defines the term Identifying assumptions		
5	Strategy and tactics	Decide an action Interact with other people		

(Ennis, 1985)

Data Analysis

The method used in this study is to use observation tests and documentation. The validity of the data from the study uses data triangulation techniques. Data triangulation is done to check the validity of the data by matching the data obtained from observation, test, and documentation. This data triangulation needs to be done because in data collection often found inequality between data obtained from one source and another source. The data analysis used is quantitative and qualitative. The planning stage is the stage of making initial observations in identifying existing problems. The implementation phase was the stage of applying mind mapping through project-based learning to improve critical thinking skills and histology concept. The observation phase was the stage of evaluating the results of critical thinking and student histology concept. The reflection phase was to analyze the learning process, critical thinking skills, and student histology concept.

RESULTS AND DISCUSSION

This research was conducted in two cycles. Each cycle of this activity consists of four stages, namely the stages of planning, implementation, observation, and reflection. The learning management system used in blended learning activities is using Edmodo (Figure 3). Learning in the cycle, I discuss material about learning theories in learning and cycle II reviews content about learning approaches. The learning process of the first and second cycle lectures using project-based learning through blended learning obtained data on critical thinking skills and student histology concept in each cycle.

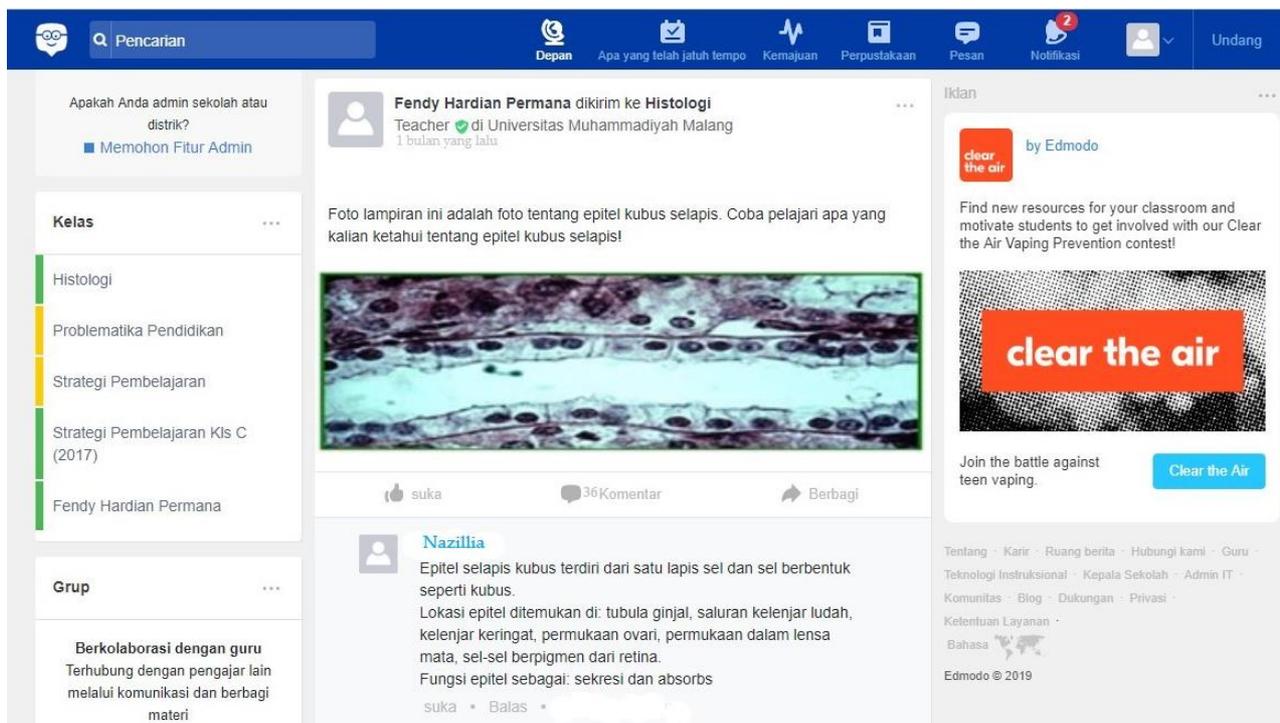


Figure 3. Learning interaction through Edmodo.

Based on the results of the research in the first cycle and second cycle for students' critical thinking skills, a change in students' critical thinking skills was obtained from cycle I to cycle II. In the first cycle, students' critical thinking skills obtained data, as in Table 3 and Table 4. In the second cycle, students' critical thinking skills were obtained by the virgin, as in Table 5 and Table 6.

Table 3.
Score distribution of indicators critical thinking from first cycle.

No	Indicator of critical thinking	Percentage of achievement (%)
1	Giving a simple explanation	70
2	Building basic skills	72
3	Concluding	70
4	Giving further explanation	70
5	Arranging strategies and techniques	71

Table 4.
Results of improving the critical thinking skills of the first cycle.

No	Completeness	KKM	F	%
1	Complete	70	8	23
2	Non-complete	70	27	77
Total			35	100

Based on [Table 3](#) can be seen that 70% of students can give a simple explanation, 72% of students can building basic skills, 70% of students can concluding, 70% of students can giving further explanation, and 71% of students can arranging strategies and techniques. The percentage shows that the achievement of students' critical thinking skills is still not maximal. [Table 4](#) it can be seen that eight students have critical thinking skills and 27 people who do not have critical thinking skills. The results of observations indicate that the causes in the first cycle are still many students who cannot think critically because students in the first cycle are still adapting to the learning activities of project-based learning through blended learning. Developing students' critical thinking potential must be carried out intensively in learning activities. The intensive activities will make students more accustomed to critical thinking. This is as stated of Anders, Stellrecht, Davis, & McCall, (2019), Zubaidah, et al. (2018), and Mahanal, et al. (2019) that the development of critical thinking in students cannot be done in a short period, there needs to be habituation so that students can easily get used to thinking critically.

Based on the findings of the first cycle, it was found that reflection to optimize project-based learning activities through blended learning was necessary to increase the intensity of learning activities. Cycle II then designed online activities (phases 4-6) which were intensified again for students. Phase 4-6 is further enhanced because the interaction between lecturers and students is more intensive so that lecturers can more easily control and develop students' critical thinking skills.

Table 5.

Score distribution of indicators critical thinking from cycle II

No	Indicator of critical thinking	Percentage of achievement (%)
1	Giving a simple explanation	82
2	Building basic skills	80
3	Concluding	83
4	Giving further explanation	82
5	Arranging strategies and techniques	80

Table 6.

Results of improvement in critical thinking skills cycle II.

No	Completeness	KKM	F	%
1	Complete	70	28	80
2	Non-complete	70	7	20
Total			35	100

Based on [Table 5](#) can be seen that 82% of students can give a simple explanation, 80% of students can building basic skills, 83% of students can concluding, 82% of students can giving further explanation, and 80% of students can arranging strategies and techniques. The percentage shows that the achievement of students' critical thinking skills is quite maximal. [Table 6](#) it can be seen that 28 students who have critical thinking skills and seven people who do not have critical thinking skills. Comparison of data obtained from the first cycle ([Table 4](#)) with the second cycle ([Table 6](#)) shows that there is an increase in critical thinking skills in students. A total of 20 students experienced an increase in critical thinking skills. Comparison of data obtained from the first cycle ([Table 3](#)) with the second cycle ([Table 5](#)) on indicators of critical thinking skills giving a simple explanation an increase of 12%, building basic skills an increase of 8%, concluding an increase of 13%, giving further explanation an increase of 12%, arranging strategies and techniques an increase of 9%. This increase shows that project-based learning activities through blended learning can develop students' critical thinking skills.

They are improving the ability of critical thinking in students because, in the project-based learning activities, students carry out a more in-depth investigation of the material being studied so

that students' thinking skills become more honed. This is as stated by Wilde-Larsson et al. (2018) that a more in-depth study conducted will make students more active and able to solve a problem.

Project-based learning activities is a learning activity where students carry out exploration, assessment, interpretation, synthesis, and information to develop student competencies (Wurdinger & Qureshi, 2015; Mosier, Bradley-Levine, & Perkins, 2016; Nassaji, 2016). The advantages of project-based learning include increasing learning motivation, improving problem-solving skills, making students more active (Mallinson, 2018; Sultana & Zaki, 2015), increasing collaboration, improving skills in managing resources, providing experience in organizing projects (Lima et al., 2017). Based on the strengthening of expert opinion, it shows that indeed, project-based learning can develop students' critical thinking skills.

The advantages of project-based learning are also supported by the implementation of these learning through blended learning so that the development of student competencies can be well controlled at all times. Blended learning is learning that is done by combining face-to-face activities in class with online learning (Cheng & Chau, 2016; Porter & Graham, 2016; Spring, Graham, & Hadlock, 2016). Blended learning has several advantages including giving more opportunities for learning and teaching outside the classroom because there is an interaction between lecturers and students who can still walk outside working hours, improvement of material and implementation of lectures can be continuously monitored (McCutcheon, Lohan, Traynor, & Martin, 2015; Norberg, Dziuban, & Moskal, 2011; Sartono, Rusdi, & Handayani, 2017), improve learning process activities outside of hours, lecture material becomes easier to access by students (Boyle, Bradley, Chalk, Jones, & Pickard, 2003; Azrai, Ernawati, & Sulistianingrum, 2017; Fauzi & Fariantika, 2018; Isfaeni, Corebima, & Suwono, 2018). Based on the strengthening of expert opinion, it shows that indeed, project-based learning through blended learning can develop students' critical thinking skills.

Based on the results of research in the first cycle and second cycle for histology concept, data obtained from the increase in histology concept for students from cycle I to cycle II was obtained. Histology concept in cycle I can be seen in Table 7. Histology concept in cycle II can be seen in Table 8.

Table 7.

Improved histology concept in cycle I.

No	Completeness	KKM	F	%
1	Complete	70	24	69
2	Non-complete	70	11	31
Total			35	100

Based on Table 7, it can be seen that 24 students have completed their histology concept - unfinished students as many as 11 students. Based on the results in the first cycle, it was shown that in the first cycle, there were still many students who had not obtained good histology concept from project-based learning activities through blended learning. This happens because students are still not accustomed to participating in these learning activities, so in the first cycle, students still adapt. Based on the results obtained from the first cycle, it shows that there is a need for intensity in project-based learning activities through blended learning.

Table 8.

Improved histology concept in cycle II.

No	Completeness	KKM	F	%
1	Complete	70	35	100
2	Non-complete	70	0	0
Total			35	100

Based on Table 8, it is known that students who complete their histology concept as many as

35 students and whose histology concept are not complete as many as 0 students. Based on the data obtained in cycle I and cycle II shows that there is an increase in student histology concept from cycle I to cycle II. Increased students who graduated from cycle I to cycle II were 11 students. The results of this study indicate the occurrence of changes in critical thinking skills and student histology concept after participating in project-based learning activities through blended learning.

CONCLUSION

Critical thinking skills in the cycle I showed that 23% were complete and 77% were non-complete, while the cycle II was 80% complete and 20% non-complete. Critical thinking skills from cycle I to cycle II increased by 57%. Histology concept in the cycle I found 69% complete and 31% non-complete, while the cycle II was 100% complete and 0% non-complete. Histology concept from cycle I to cycle II increased by 31%. The results of the study indicate that there is a development of critical thinking skills and student histology concept from project-based learning through blended learning. Based on this, it can be concluded that project-based learning can develop critical thinking skills and student histology concept.

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