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Analysis of Students' Collaborative, Communication, Critical Thinking, and Creative Abilities through Problem-Based Learning

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Abstract

Students' collaborative, critical thinking, creative thinking, and communication skills need to be trained using problem-based learning on sharing and jumping tasks, which has never been studied. This study aimed to analyze students' collaborative, communication, critical, and creative thinking skills using Problem-Based Learning (PBL). This type of research is descriptive. The research design uses a Lesson Study-based case study. The population in this study were all 5th-semester students who attended lectures on Human and Animal Anatomy Physiology at the Biology Education Study Program, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang, the Academic year 2021/2022. The sample of this study was students of class 5C with 38 people (total sampling). Data were collected by observation by eight observers using an assessment rubric. Aspects that are measured include critical thinking, creative, collaborative, and communication skills through descriptive quantitative data analysis with percentages. The results showed that students' collaborative, critical thinking, creative thinking, and communication skills were in the good category. There was an increase in the first and second cycles through problem-based learning. The findings of this study are problem-solving-oriented learning can improve classical 4C skills.

Keywords: classical 4C skills; lesson study; problem-based learning

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INTRODUCTION

Assessment and Teaching of 21st Century Skills organize 21st-century skills, knowledge, attitudes, values, and ethics into four categories, namely (1) ways of thinking, including creativity and innovation, critical thinking, problem-solving, decision making, and learning about learning (metacognition); (2) working methods include communication, collaboration, and teamwork skills; (3) tools for work include general knowledge and literacy of communication and information technology; and (4) living in the world includes citizenship, life, and career, personal and social responsibilities, as well as competence and cultural awareness (Saavedra & Opfer, 2012).

The 21st-century skills or 4Cs have been regulated by law that educators, teachers, lecturers must have these four skills. The National Education Association has identified 21st-century skills as "The 4Cs" skills, including creativity, communication, collaboration, and critical thinking (Redhana, 2019; Yokhebed, 2019). These skills are also needed for Biology Education students as prospective educators

and involved in the community in the education aspect (Afandi et al., 2019; Berg et al., 2021; Kim et al., 2019; Pandiya, 2014; Susilo et al., 2020; Tanner, 2013).

Biology learning as science has three aspects: the hands-on aspect related to scientific work developed through minds on knowledge in a heart-on way, namely the ability to build knowledge concepts through direct experience with a scientific attitude (Hasanah et al., 2020). Improving the quality of graduates to prepare professional Biology teacher candidates should be carried out in terms of Biology knowledge and the ability to carry out professional development as educators who have important responsibilities and wars in the advancement of education (Adnyani, 2015; Faisal & Martin, 2019; Meiers, 2007; Nguyen et al., 2020). One way that can be done is to get used to innovative learning activities in lectures that can stimulate the mindset to lead to critical, creative, collaborative, and communication thinking skills (Erdoğan, 2019; Peters-burton & Stehle, 2019; Wrahatnolo & Munoto, 2018).

Students who program the Human and Animal Anatomy Physiology course in the 2021/2022 Academic Year have generally never been given case questions that lead to solving a topic problem or learning material. There is a need for habituation and implementation of learning activities that hone students' critical, creative, collaborative, and communication thinking skills. Many learning models can be used, one of which is the Problem Based Learning (PBL) learning model. PBL can be a learning model that can be used to improve 21st century or 4C skills (Priyatni & As'ari, 2019; Ratminingsih et al., 2021).

Problem-based learning (PBL) is a learning model that motivates students to learn by solving problems and developing critical thinking skills (Masek, 2012; Masrinah et al., 2019). This model focuses on the problems presented by the teacher, and students solve these problems with all their knowledge and skills from various sources that can be obtained (Maryati, 2018). The activity phases of the PBL model can accommodate 21st-century students' abilities, namely: discovery and problem-solving activities are phases for solving problems that exist in real life (Putri et al., 2015).

Based on the facts and explanations above, the researchers consider it important to analyze the abilities of the 21st century or 4C on students. The research results are expected to be useful for measuring students' abilities and evaluating learning activities to improve the quality of learning. This study aimed to analyze students' critical, creative, collaborative, and communication thinking skills through Problem-Based Learning (PBL).

METHOD

General Background

This type of research is quantitative descriptive. The research design uses a case study, applying Lesson Study. The research subjects are 5th-semester students who program and attend lectures on Human and Animal Anatomy Physiology at the Biology Education Study Program, Faculty of Teacher Training and Education, University of Muhammadiyah Malang, 2021/2022. The material chosen is the digestive system topic in ruminants, poultry, and poultry respiration related to structure and physiology. The population in this study were all 5th-semester students who attended lectures on Human and Animal Anatomy Physiology. The sample of this study was students of class 5C with 38 people (Total sampling).

Procedure and Instrument

The research procedure includes 1) Learning planning (Plan), planning activities between the model lecturer and the observer. This activity discusses (a) lecture/learning materials, (b) learning objectives, (c) Student Worksheets (LKM); problem-based LKMs are presented in practice questions and discussions that lead to problem-solving, which are made into two types, namely sharing tasks and jumping tasks, (d) sharing and observing tasks, (e) learning activity scenarios, (f) measuring student abilities and the tools used to collect data, (g) reporting findings, 2) Implementation (Do), learning activities use zoom meeting, (a) all components involved in one room, (b) lecturers explain learning scenarios and discussion activities in each breakroom which have been divided based on small groups, (c)) each group has one observer, 3) Reflection (see) is done outside of learning activities. Each observer reports the findings in each group.

Data Collection and Analysis

Data collection was carried out by observations made by eight observers using an assessment rubric. Aspects that are measured include critical thinking, creative, collaborative, and communication skills. Data analysis was descriptive qualitative, and quantitative, namely by calculating the percentage of each 4C ability criteria (critical thinking, creative, collaborative, and communication skills) students and describing the observers' findings in each group during learning activities. The assessment criteria and rubrics are presented in Table 1 (Adopted from Maryuningsih et al., 2020; Nurlenasari et al., 2019; Purwasih et al., 2021).

Table 1. 21st Century Skills Assessment Criteria Rubrics

Ability Type	Criteria		
	Very good	**Good**	**Not good**
Communication	If ≥ 4 students in the group are actively involved in communication.	If communication is only done by 2-3 students.	If communication is only carried out by ≤ 1 student/does not occur
Collaboration	If ≥ 4 students in the group are involved in collaboration.	If 2-3 students in the group are involved in collaboration.	If there is no collaboration between students (work alone)
Critical thinking	If ≥ 4 students give rational reasons/arguments, focus their attention, produce conclusions, understand the key to the problem, provide explanations.	If only 2-3 students give rational reasons/arguments, focus their attention, produce conclusions, understand the key to the problem, provide explanations	If 1 student who gives rational reasons/arguments, focuses his attention, produces conclusions, understands the key to the problem, provides an explanation
Creative Thinking	If ≥4 students show fluency, flexibility, novelty.	If only 2-3 students show fluency, flexibility, novelty.	If only ≤ 1 student shows fluency, flexibility, novelty.

Data analysis

This study collected two types of data from students via questionnaires: the first was data on students' cognitive capacities or knowledge of topics, and the second was

data on students ' mental models before and after receiving particular research therapy. The first analysis was conducted based mainly on data collected by reading the responses from each student and evaluating the students' first comprehension of covid-19, followed by analyzing the keywords used in each student's replies (Marthoenis et al., 2021; Varela et al., 2020; Yuzulia, 2021). The categories used were established separately by the researcher to improve inter-rater validity and demonstrate the degree of triangulation of the qualitative study done by the researcher. To determine the consistency of the assessment (coding), and the reliability coefficient of each ratter, the assessment (coding) of each ratter is compared (Varela et al., 2020). The reliability findings revealed that 83% of the evaluations between ratters were possible for reliability. In contrast, researchers and ratters would review others who did not match the level of accuracy via an agreement.

The secondary data analysis was modified from the Varela analysis approach (Varela et al., 2020) by extensively examining the responses to each questionnaire and connecting them to (conceptual) knowledge, which would subsequently be referred to as mental models or explanatory models. First exams are given to data to identify their initial mental models, which are then evaluated for the students' final examinations. Because the mental model in this study is unique, particular assessment indicators, such as the level of sophistication of student questionnaire replies, must be established (Darabi et al., 2010; Varela et al., 2020; Yuzulia, 2021).

RESULTS AND DISCUSSION

Collaborative Ability

The results showed that students' collaborative abilities varied greatly from one student to another. Analysis of small group observations showed that in the aspect of the collaborative ability, as much as 88.9% were in the good category and 11.1% were in the not good category in the first cycle. There was an increase in the second cycle, namely 44.4% there was an increase in the very good criteria, which was initially only 0% of students even though they were still in the not good category. The results of observations of collaborative abilities are presented in Figure 1.

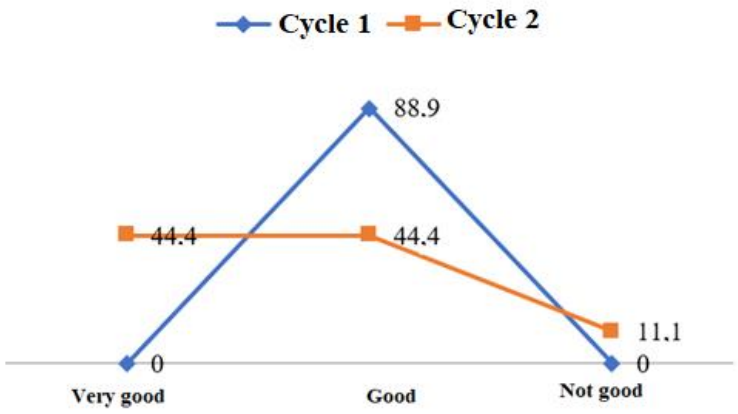

Figure 1. Percentage of Collaborative Ability

Based on Figure 1, it can be seen that the collaborative ability of students varies greatly from one student to another. In line with the current results, Sulistyawati and Zuchdi's (2016) research found that these varied conditions take a long time and require seriousness to improve students' ability to collaborate in their groups.

Learning that emphasizes collaborative skills can be done both inside and outside the learning classroom that involves students in a group to build knowledge and achieve learning goals (Warsono & Hariyanto, 2013). Learning activities with problem-based learning models contained in the provision of student worksheets are given to small groups containing questions and discussion materials. The material problems that each member in the group must resolve provide opportunities for students to exchange information and collaborate in solving the problems given by the lecturer.

These results are in accordance with the observer's observations on students' collaborative abilities. In the learning activities, active group discussions took place, although in general, only three members were very visible, giving ideas and collaborating in solving sharing tasks. Each group member complements each other in choosing words in constructing sentences and looking at the data on the questions. Students will learn better if they are actively involved in the learning process in small groups (Septikasari & Frasandy, 2018). Furthermore, students who work in small groups learn more about teaching materials and remember them (Warsono & Hariyanto, 2013).

Communication Ability

The results of observations of student communication skills showed that in general, it showed that in the first cycle, 88.9% were in the good category, and 11% were not good. In the second cycle, there was an increase of 44.4%, including very good criteria. However, there was a decrease of 44.4% on good criteria. The results of observing collaboration abilities are presented in Figure 2.

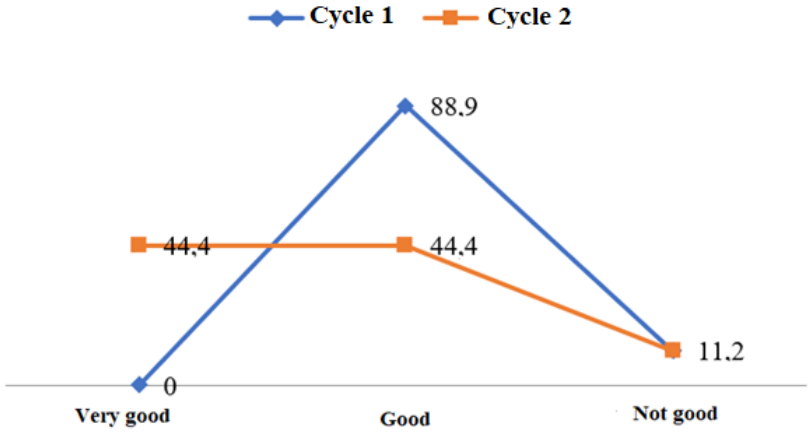

Figure 2. Percentage of Communication Ability

Communication skills include conveying thoughts clearly and persuasively orally and in writing (Septikasari & Frasandy, 2018). The problems contained in the discussion materials and practice questions are presented into two types: sharing tasks and jumping tasks to accommodate students' opportunities to communicate with each other. This is in accordance with the data obtained by the observer, namely, each student in small groups in the most active discussion activities, mostly three students. Group members ask each other questions. Some students took the initiative to find sources using the internet and articles. Educators must have the ability to convey ideas and learning materials related to principles, concepts, and procedures properly so that students can receive and understand what educators convey information. The communicant, namely students, will accept communication messages if the communicant understands what the communicator or educator is conveying (Haris,

2008). A good discussion is supported by the cooperation between members, which shows good interaction in the group (Veldman et al., 2020).

Critical Thinking Ability

Critical thinking is one of the higher-order thinking skills (HOTS) in addition to creative thinking, problem-solving, and reflective thinking (Hidayah et al., 2017). The results of observations of students' critical thinking abilities were varied, in the observation of small groups in the first cycle, it showed that 77.8% of students' critical thinking abilities were in the good category, and 22.2% in the bad category. In the second cycle, there was an increase of 44.4% of students' critical thinking skills in the very good category and a decrease in the percentage of the not good category to 0%. The results of the observations are presented in Figure 3.

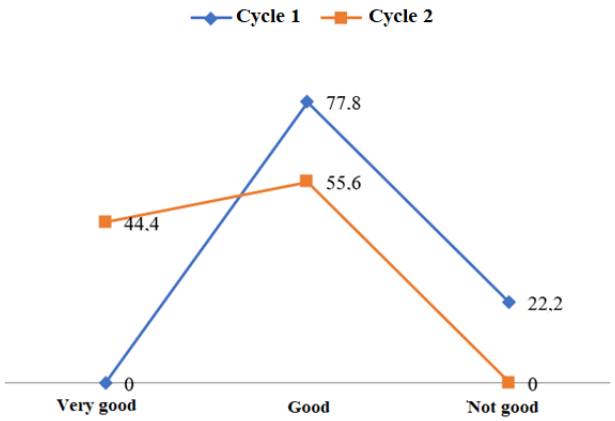

Figure 3. Percentage of Critical Thinking Ability

Student worksheets that are distributed to each group contain questions that accommodate students to think critically. In the presentation of jumping task questions, data is presented on the difference between the feed consumed by ruminants and the number of feces excreted so there is a data ratio. Each group member is required to analyze statistical data and relate it to material related to the biochemical processes that exist in the digestive system of ruminants.

The activity phases of the PBL model can accommodate students' critical thinking skills, namely: problem finding activities are a phase for compiling problems that exist in real life (Putri et al., 2015). Furthermore, Putri et al. (2015) stated that the PBL model can improve students' critical thinking skills. Research on the use of PBL to improve critical thinking skills has been carried out (Agnafia, 2019; Mustika et al., 2014), and it is known that students' critical thinking skills have increased in the moderate category after the implementation of the PBL model.

Creative Thinking Ability

The observations of students' creative thinking abilities showed that 44% were in the good category and 55% in the not good category in the first cycle. In the second cycle, there was an increase of 22% in the very good category, which was initially 0% in the first cycle, and an increase of 33.4% in the good category and the not good category to 0%. The results of the observations are presented in Figure 4.

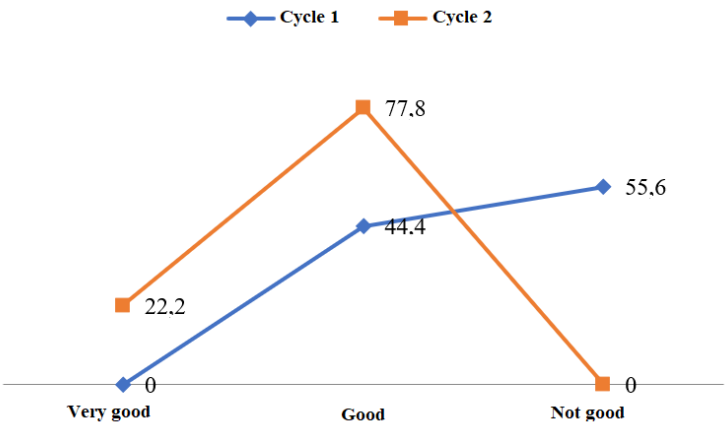

Figure 4. Percentage of Creative Thinking Ability

The results show that the students' creative thinking skills are in the category and very good. The results mean that PBL can improve students' creative thinking skills. This is in line with Khoiriyah and Husamah's (2018) findings that teachers can apply PBL to improve creative thinking skills, problem-solving skills, and student learning outcomes. Meanwhile, Wenno et al. (2021) state that PBL improves students' creative and critical thinking skills on science material.

Each group member interacts with each other to discuss engaging data presentations. A problem has been given in the worksheet, namely data about diseases in cattle farms. Students are required to present communicative and relevant data to the data to be presented in scientific activities or forums. The creative process will only occur if it is generated through problems that spur on five kinds of creative behavior: 1) Fluency, namely the ability to express similar ideas to solve a problem; 2) Flexibility, namely the ability to generate various ideas to solve a problem outside the usual category; 3) Originality, namely the ability to provide a unique or extraordinary response; 4) Elaboration (details), namely the ability to state the direction of ideas in detail to make ideas into reality; 5) Sensitivity, namely the sensitivity to catch and produce problems in response to a situation (Sasmita, 2018).

CONCLUSION

This research concludes that, in general, students' collaborative, critical thinking, creative thinking, and communication skills are in the good category. There was an increase in the first and second cycles through problem-based learning. Problem-solving-oriented learning can improve classical 4C skills.

RECOMMENDATION

The program is very useful for training 4C skills for students, so the partnership program for LPTK lecturers and teachers in schools needs to be continued. Furthermore, the maintainance of collaboration in teaching students and research that focuses on the diversity of other materials in science/biology and other 21st century skills needs to be done.

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DECLARATION OF INTEREST

The author/s declare no conflict of interest.

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