

Case method to increase student participation and problem-solving skills in biochemistry subject lesson study integrated at Khairun University

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Abstract

The Biochemistry course is a basic and compulsory subject for Biology Education students. This study aims to determine students' level of participation and problem-solving skills through the ability to solve cases of Biomolecules and proteins on Student Worksheets (LKM). This is an Action Research integrated with lesson study with two cycles. The instruments used were student participation rubrics in the case method and LKM problem-solving skills in the Biochemistry course. The subjects in this study were 24 third-semester students of the Biology Education Study Program. Data analysis techniques through descriptive statistics with percentages. The results showed an increase in the percentage from cycle 1 to cycle 2. Student participation in collaborative activities increased from 71.5% to 73.3%, while problem-solving skills increased from 53.5% to 71.7%. Based on the observer transcripts, some students still do not understand the material and cases discussed in lectures in class and the laboratory. This is because students do not actively ask questions and do not have curiosity about the material and case explanations presented by lecturers or fellow students. This study shows that implementing the integrated case method in lesson study can increase student participation activities and problem-solving skills in Biochemistry courses.

Abstrak

Matakuliah Biokimia merupakan matakuliah dasar dan wajib bagi mahasiswa Pendidikan Biologi. Penelitian ini bertujuan untuk mengetahui tingkat partisipasi dan *problem-solving skill* mahasiswa melalui kemampuan menyelesaikan kasus-kasus konsep Biomolekul dan protein pada Lembar Kerja Mahasiswa (LKM). Ini adalah penelitian *Action Reseach* terintegrasi *lesson study* dengan dua siklus. Instrumen yang digunakan adalah rubrik partisipasi mahasiswa dalam *case method* dan LKM *problem-solving skill* matakuliah Biokimia. Subjek dalam penelitian ini adalah 24 mahasiswa semester 3 prodi Pendidikan Biologi. Teknik analisis data melalui statistik deskriptif dengan persentase. Hasil penelitian menunjukkan peningkatan persentasi dari siklus 1 ke siklus 2. Aktivitas partisipasi mahasiswa dalam kolaborasi dari 71,5% menjadi 73,3%, sedangkan *problem-solving skill* mahasiswa dari 53,5% menjadi 71,7%. Berdasarkan transkrip observer masih ada mahasiswa yang kurang memahami materi dan kasus yang didiskusikan dalam perkuliahan di kelas maupun di laboratorium. Hal ini karena mahasiswa tidak aktif bertanya dan tidak memiliki rasa ingin tahu terhadap materi dan penjelasan kasus yang disampaikan oleh dosen atau sesama mahasiswa. Penelitian ini menunjukkan bahwa implementasi *case method* terintergrasi dalam *lesson study* dapat meningkatkan aktivitas partisipasi dan *problem-solving skill* mahasiswa pada matakuliah Biokimia.

A. Introduction

Biochemistry is a basic science that is transdisciplinary. Biochemistry can involve various fields of knowledge and continues to experience development at any time (Bobich, 2008; Bell, 2001). The Biochemistry course teaches about the structure and function of biomolecules and metabolism, starting from glycolysis, oxidative decarboxylation, and the citric acid cycle to the basic concept of electron transfer. In Biochemistry lectures, the use of factual cases is something that cannot be separated. Biochemistry continues to experience breakthroughs from time to time, so basic biochemical concepts and the latest information from biochemistry must become the concern of students and lecturers (Cicuto et al., 2019). Learning by using factual cases allows students to deepen the concepts they have learned. Learning using authentic cases can use various approaches, for example, case methods and teaching materials, including scientific articles to study a problem (Drake et al., 1997; Fortner, 1999), material for discussion in small groups (Cornely, 1999; Levine, 2001; Mulnix, 2003; Walczak & Jackson, 2007), forming a journal club (Glazer, 2000; Roberts, 2009) and as homework (Roecker, 2007). Biochemistry courses with factual cases in scientific articles in practice are included in inquiry-based learning (Walczak & Jackson, 2007; Roberts, 2009; Roecker, 2007; Drake et al., 1997).

Furthermore, the implementation of learning in universities, policies, and regulations that become the minimum standard are the National Higher Education Standard (SN-DIKTI), and the last published is Permendikbud Number 3 of 2020 concerning National Higher Education Standards. In this era of industrial revolution 4.0, a policy of the Ministry of Education and Culture has been issued, known as Merdeka Learning-Merdeka Campus. This policy aims to encourage students to master various useful sciences in work. In the learning process, there must be a link and match between learning materials and activities with real problems that occur in life, which are generally known as problem-based learning methods. The Ministry of Education and Culture has issued Decree Number 754 LP/2020 concerning the Main Performance Indicators (IKU) of Higher Education, namely classroom learning: using one or a combination of case-solving learning methods (case method) and project-based learning (project-based learning) and covering 50% in the evaluation weight. The Ministry of Education and Culture's policy as stated in Permendikbud No. 3 of 2020 is committed to improving the quality of higher education graduates following the needs of the

world of work in the future. This policy is reinforced by the Decree of the Minister of Education and Culture No. 754/P/2020 concerning the Main Performance Indicators (KPI) for Higher Education that Higher Education must achieve the IKU No. 7, namely classroom learning that uses case-solving learning methods (case method) as part of the weight evaluation. Learning using the case method will provide many opportunities for students to develop the ability to work together because it gives greater weight to the discussion process (peer discussion) and individual learning.

Based on the results of observations made by researchers during the initial lecture before being given the topic of cases of the nature and characteristics of Biomolecules to be discussed with the group team, three-semester students of the Khairun University Biology Study Program were less active. Most of them did not understand the lecture material from the learning process and related questions and answers that were previously explained during the lecture material. One of the efforts to solve these problems is to use different learning methods to implement real cases with the help of several media in learning. There are various kinds and types of learning methods with their respective benefits and advantages. Still, this study will apply a case method to increase participation and problem-solving skills in solving case topics discussed in the laboratory/classroom. Students are required to actively participate in finding and solving real problems as a context for them to learn critical thinking and problem-solving skills and gain knowledge using this learning method. Furthermore, this method can help students find ideas and answers from the cases discussed.

In connection with the above, in 2022, the Biology Education Study Program FKIP Khairun University will be one of the recipients of the LPTK Lecturer Partnership program with partner school teachers intending to implement Lesson studies for sharing and collaboration on the effectiveness of the case method approach in Biochemistry courses. Lesson study is one of the models for fostering the teaching profession through collaborative and sustainable learning assessments based on the principles of collegiality and mutual learning, as well as building a learning community. Lesson study is a process of developing the professional competence of teachers/lecturers that is developed systematically in the education system in Japan with the main goal of making the learning process better and more effective. In these activities, the teachers/lecturers jointly plan, observe, analyse,

and improve their learning (Lim-Ratnam, 2013, Rusman, 2011, Widhiartha et al., 2008, Susilo, 2006). This study aims to determine the level of participation and problem-solving skills of students through the ability to solve cases related to the concept of biomolecules and proteins in LKM, starting from the identification of facts, biomolecular theory, characteristics and properties and functions of biomolecules, especially proteins with an integrated case method approach lesson study.

B. Material and Method

The research method used is Classroom Action Research integrated with lesson study. Data collection consisted of qualitative and quantitative data, the implementation of the research involved colleagues as observers. The design of classroom action research is the action of researchers by identifying and solving a problem, planning solutions and taking action, as well as observing and reflecting. Reflection activities are used as benchmarks in drawing conclusions about the problems developed, so that they can be used to assess the validity of the recommended solutions in learning. For more details regarding the stages in the Classroom Action Research cycle, below is presented an overview of the cycle in research as Figure 1.

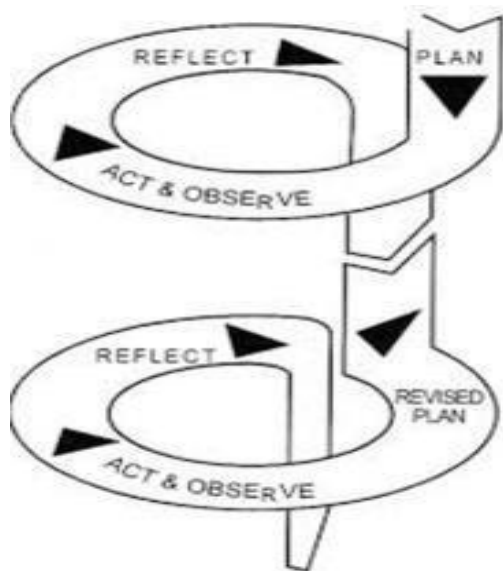


Figure 1
Kemmis & McTaggart's Action Research Model (1982)

Classroom Action Research introduced by Kemmis & McTaggart (1982) is used as a systematic research to answer learning problems in the classroom through planning studies, action, observation, reflection and repetition of planning.

The data analysis technique used is data triangulation and descriptive analysis with percentages

C. Results and Discussion

The research which was conducted from September to October 2022 in the Biochemistry course in the Biology Education study program began with initial reflection activities on case method-based learning and the preparation of lesson plans and case method-based design lessons. The learning activities using the case method approach are divided into several stages, namely:

- 1) Preparation.
 - a) At this stage the research team identified learning problems in class and prepared lesson designs by selecting several case topics to be discussed (written form).
 - b) The research team divided the participants into 6 groups consisting of 4 students.
 - c) The research team prepared assessment instruments in the form of a rubric case method (observation sheets for student participation activities), problem-solving rubrics and documentation of student activities.
- 2) Execution.
 - a) Lecturers explain learning objectives and case solving scenarios in videos and online mass media and share cases in LKM.
 - b) At this stage, students are instructed to start identifying facts, concepts in solving case topics that have been given to each group.
 - c) Searching for data, information, theory, submitting ideas from discussion group members and formulating solutions and making work results in the form of written reports that will be presented classically in class.
 - d) The research team (lecturers) conducted an assessment using a rubric and the results of discussions at the LKM.
- 3) Observations (observations) are made during the learning process takes place.
 - a) The observer uses an observation sheet instrument which is equipped with observation notes during the learning process.
- 4) Reflections are carried out at the end of each open class by model lecturers and observers to convey lessons learned and findings from learning outcomes with the case method.

The student learning outcomes from the implementation of the case method approach for 2 cycles (Plan Do See) implementation of the 2022

LPTK lecturer partnership lesson study program are as shown in Figures 2 and 3.

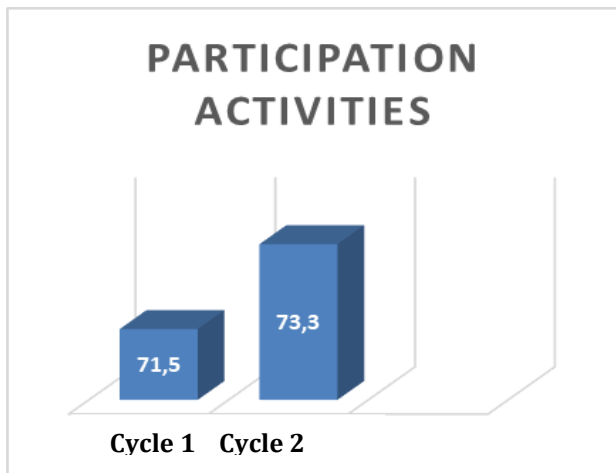


Figure 2
 Observation results of student participation activities in case method discussions in cycles 1 and 2

Based on Figure 2, it can be stated that student participation activities in discussions to find recommended solutions to the cases discussed in the case method increased from cycle 1 to cycle 2. Furthermore, the learning outcomes of problem-solving skills can be seen in Figure 3.

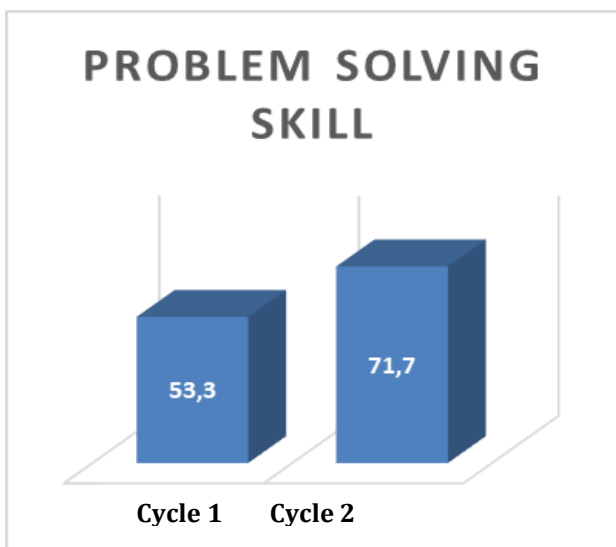


Figure 3
 Observation results of student problem-solving skill activities in case method discussions in cycles 1 and 2.

Based on Figure 2 above, it can be seen that the activity of problem-solving skills in the case method has increased from cycle 1 to cycle 2. Furthermore, based on the results of research in class, student activities that can be observed during lecture activities are seen from student feedback during learning by presenting real cases related to

biochemical concepts, namely biomolecules and the structure and function of proteins. Some of the activity criteria that appeared during the observation included: group participation activities in finding goals and root causes, communication in sharing ideas in groups to formulate goals; business activities to find solutions to the selected cases discussed, positive attitude respecting friends in the group. Furthermore, problem-solving skill activities consist of: problem definition, strategy identification, formulating goals, evaluating potential solutions, implementing solutions and evaluating outputs or solution recommendations.

In this study the cases selected for cycle 1 were 1) cases of rice, sugar, eggs and counterfeit oil on the market and news on social media and online mass media. Popular videos test real or fake ingredients. Whereas the cases in cycle 2 were: 1) cases of fever and steps in children, 2) cases of illicit alcohol consumed as liquor, 3) heavy metal pollution in aquatic animals. All cases correlated with protein and protein properties. The student responses after being given a questionnaire about the Biochemistry study strategy can be seen in Figure 4.

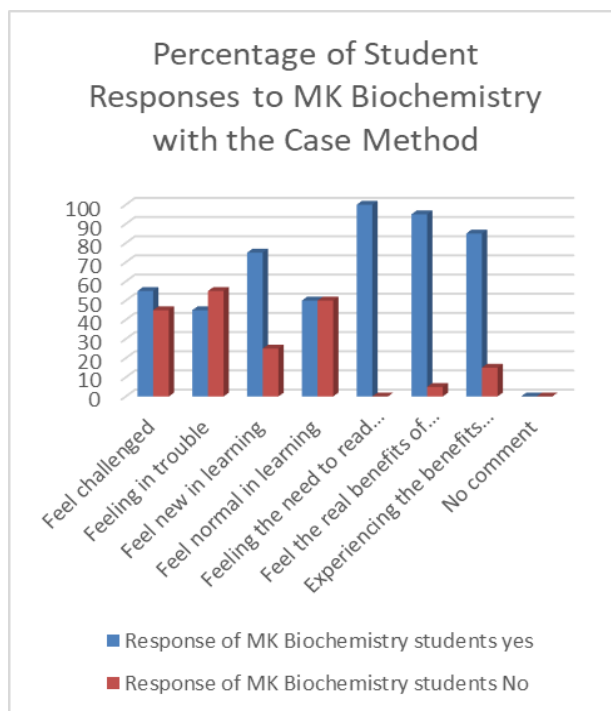


Figure 4
 Responses of semester 3 students after implementing the case method approach

The case method approach is one of the best ways to prepare students for challenges, collaboration and problem-solving. Through a dynamic process of exchanging perspectives and building ideas from one another, students become

proficient in analysing problems, practicing judgment, and making difficult decisions. The case method is a participatory and discussion-based learning method in which students acquire skills in critical thinking, communication, and group dynamics. The development of science and technology requires us to return to the idea that children will learn better if the environment is created naturally. Learning will be more meaningful if the child experiences what he is learning, not knowing it. Learning that is oriented towards mastery of the material has proven to be successful in short-term memory competitions but failed to equip children to solve problems in long-term life (Mumtaha & Khoiri, 2019; Rezky et al., 2019; Ghufron, 2018).

To achieve the main performance indicators (IKU) of higher education in accordance with the Decree of the Minister of Education and Culture Number 754/P/2020 which targets to improve the quality of higher education graduates and the quality of the curriculum as evaluation weights, it can be seen from learning activities. Education in higher education must be able to open opportunities for students to develop their abilities, actualize themselves, and this is the biggest challenge for lecturers. Students must be facilitated in order to produce a superior achievement, lest potential remains a potential. As educators, lecturers must always reconstruct learning.

This is the basis for conducting case method-based learning research, especially in Biochemistry courses through the LPTK lecturer partnership program. In this learning process, it is not only students who study but also teaching staff, and one thing that must be considered is learning resources. The quality of learning success with the case method has been carried out by several studies, among these successes are the communication factors between lecturers and students, as well as feedback from lecturers. In addition, how to motivate students by changing learning methods and media that were previously conventional to be innovative and meaningful. The effectiveness of learning outcomes occurs if there is a positive change in the form of behavior, then the designed learning objectives are achieved according to a predetermined learning plan.

Case method-based learning is carried out in the classroom through the integration of practicum and theory as well as group discussions in student-centered classroom activities and allows students to learn to utilize various learning resources that do not only make lecturers the only source of learning. Through this learning, students will also be actively involved in their mental processes

through discussion, analysis and problem-solving activities from a case (Bayona & Castañeda, 2017; Cunningham et al., 2017). With this concept, learning outcomes are expected to be more meaningful for students. The learning process takes place naturally in the form of student activities working and experiencing, not transferring knowledge from lecturers to students. This is evidenced by an increase in student participation activities in groups and an increase in student problem-solving skills during the implementation of case-based learning methods. In the implementation of the lesson study-based case method in the biochemistry course, the lecturer facilitates students to carry out discussion and case solving activities and find theoretical recommendations. During the learning process, both practicum and group discussions, lecturers provide explanations, guide discussions, give instructions, ask questions, provide comments, and provide suggestions to students. Furthermore, lecturers must condition the learning atmosphere through creating a conducive climate, by providing various support facilities, media, and materials (Bayona & Castañeda, 2017; Cunningham et al., 2017).

Thus participatory abilities, problem-solving and understanding of biochemical concepts in students can be optimal with the application of case method based learning through the implementation of lesson study. The learning process for the Biochemistry course with lesson study in the Biology Education Study Program, FKIP, Khairun University was able to improve learning practices in the laboratory and in the classroom and can increase group participation, creativity and motivate students in learning. Increased student motivation with lesson study learning because learning is focused on students, both in learning observation, learning atmosphere, learning motivation and in selecting learning strategies. Apart from that, because of good learning planning, interesting learning media, lecturer cooperation and thorough observer observation. This is in line with Widayati's research (2018); Ahmadi & Hamang (2017); Farida (2016); Mas'ud & Sundari (2018). Thus, it can be said that the implementation of lesson study in Biochemistry lectures with the case method approach is able to improve the quality of learning. This is indicated by the increased activity of participation and problem-solving skills of students in participating in learning the concept of Biomolecules and Proteins as well as positive responses to the implementation of lesson study from students and lecturers.

D. Conclusion

Based on the results of data analysis and discussion of research results, it can be concluded that case method-based learning through the lesson study approach can increase student participation activities in collaboration and problem-solving skills of students in learning biochemistry. This is evidenced by an increase in participatory activity and student problem-solving skills. There is a change in action and the case method lecture method, case discussion makes students interested in knowing more about the benefits of biochemistry science in everyday life.

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