

The Modified Case-Based Methods in Combination with Team-Based Approach for Teaching General Microbiology at Agricultural Product Technology Department of Andalas University

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ABSTRACT

The objective of this paper is to investigate the effect of the modified case-based method in combination with the team-based approach in accomplishing subject learning objectives, student perceptiveness of the cognitive learning objective, and increasing student group participation. The Teaching was held online using "Ilearn", a Moodle platform. Students were given reading materials to study before the pre-test and solved cases. The observation showed an insignificant effect on the student test score but increased student perception of the cognitive learning objective and student participation in group work.

Keywords: Case-based method, Student Centre Learning, Active learning, Team-based Approach

1. INTRODUCTION

General Microbiology (GM) is a mandatory prerequisite course in the Agricultural Product Technology Study Program (PS-THP). This course has a credit load of two and appears in the third semester. The General Microbiology course discusses the role of microorganisms in agriculture (soil, food, plant diseases), the introduction of types of microorganisms (viruses, bacteria, fungi, algae, protozoa, and nematodes), nutrition needs, development and growth of microorganisms, metabolism of microorganisms (use of energy, enzymes, fermentation, biosynthesis, elemental cycles), basic genetics of microorganisms, and management and control of microorganisms. Learning outcomes (CPL) of the subject are grouped in main competencies of microbiology and agricultural product safety.

GM classes during the Covid-19 pandemic were carried out completely online. Transfer of knowledge by lecturers was done through the traditional method, lectures. Learning activities had a basic structure, consisting of lectures, several assignments along one semester, mid-semester exam, and final exam. There was no formative assessment and immediate feedback.

Exam results in GM class during 2020 were in the range of 35 – 79 points, with an average score of 54 points. At the same time, active participation in classroom activities ranged from 32 to 97 %, with an average of 79 %. The improvement is necessary since 54 points are considered a low score. Participation in-class activity also needs to be enhanced due to its vital role in improving student performance.

1.1. Active Learning

Active learning is a learning process that involves interaction between teachers and students in various activities and inquiries. The difference between active learning and traditional system lectures is the variety of activities in increasing students' participation during the learning process. Various studies have shown that the interactive method is more effective than traditional lecture [1].

The case-Based Method (CBM) is an active learning method of learning by doing. CBM helps students build their skills in analyzing, decision-making, and internalizing the learning process. Students also learn to find solutions to factual problems, develop oral communication skills and teamwork [2].

The State University of New York at Buffalo has used the case in some courses, including: (1) Scientific Methods course, (2) Big Inventions general lecture, and (3) Biology course and practice in a large class. When the case method is used occasionally in the classroom, it supports the class by showing students how their learning activities can contribute to the world. However, lecturers and students are not comfortable using it [2].

Team-based learning is different from other small group activities that involve building teams and using them as part of an instructional strategy. The application of the team learning model requires linkages between learning activities and explicitly designs assignments for two purposes: (1) expanding student learning and (2) promoting the development of high-performed learning teams [3].

The combination of CBM with team-based learning is expected to lower group dysfunction. By giving a reasonably large responsibility complete with consequences, students can comprehend the importance of contributing to every activity individually and in the team. With the team learning model, students are more focused on producing reasonable case solutions since

basic knowledge was already covered in pre-reading and pre-test.

2. METHODS

The data for analysis were drawn from students who participated in the General Microbiology Course in the second semester of 2021. 100 students were distributed into four classes, A (15 people), B (19 people), C (43 people), and D (25 people). This division was based on the choice of students. Each class was given the same treatment.

2.1. Course Design

The course was designed according to an adapted modular structure (**Figure 1**). Approximately 60 minutes (60%) were allocated for student interaction in groups during the class meeting. This interaction included discussions relevant to the activity, namely (1) discussions about pre-test questions and (2) discussions about cases presented. The main elements used were (1) team formation, (2) pre-test, (2) feedback in the form of group discussions, and (4) discussion in solving problems.



Figure 1. Description of Structure of Learning Activity

2.2. Reading Materials Preparation

Students read the text according to the topic discussed in the current materials before class. It covered important material on the topic, and student's knowledge and understanding were tested in a pre-test. Materials were distributed to students in digital format (PDF) a few days before the meeting.

2.3. Pre-Test Questions Preparation

10 to 13 relevant questions were prepared according to the sub-learning objective of the course for each week. Variations of questions on the quiz included multiple choices, true-false, and short essays. The test questions cover cognitive abilities, including (1) recalling and (2) understanding concepts. This quiz was held at the beginning of the meeting. Students were given 20 minutes to answer.

2.4. Pre-Test Questions Preparation

Classes were conducted online using Ilearn, a Moodle-based platform. The designed activities consisted of activities that support CBM learning with a team-based approach (**Table 1**).

2.5. Data Collected

The data from Pre-test and mid-test scores were used to investigate the improvement of test scores and student perception towards the learning method; questionnaire responses were collected. The test score level range was from 0 to 100. While questionnaire used Likert rating scale of 1 (strongly disagree) to 5 (strongly agree).

Table 1. List of Activity Provided in ILearn

No	Activity	Objective
1	File	Reading materials and cases sharing
2	Page	Copy of Pre-test question publishing
3	Quiz	Pre-Test managing
4	Forum	Discussion forum for Pre-Test answer and case solution
5	Assignment	Case discussion report and inquiry report uploading location

2.6. Statistical Analysis

The data collected were analyzed using t-test, except for participation, which used average percentages.

3. RESULTS AND DISCUSSIONS

3.1. Evaluation of Pre-test and Mid-test Score

Modified CBM system with a team approach had no significant effect on increasing student scores, as shown in **Table 2**. The use of reading materials before class motivated students to learn, as showed by the score gained of 68.32, although there was no significant score after the pre-test. These results align with [6] findings in the Biology class. There was no significant increase in score after students were given treatment with high structure learning. This is because the test coverage is limited to recall questions (Bloom level 1) and concept understanding (Bloom level 2). It is known that active learning does not have a significant effect on the mastering of knowledge and concept understanding but rather on improving capability in a higher level of Bloom's taxonomy.

Begin the class with Pre-Tests before the discussion session motivates students to study. This can be seen from the average score of the mid-test that is sufficient to pass the course. Pre-class readiness exams can increase learning effectiveness, especially

to reach Bloom's taxonomy level 3 and above [7]. Students have more time to explore their abilities in practice, analyze, synthesize, investigate, and evaluate. Thus, the burden of coverage that each meeting must complete can be reduced. So, active learning can be carried out optimally. According to Bloom's taxonomy, mastery of knowledge and understanding levels 1 and 2 can be obtained by reading the material and listening to lectures.

3.2. Student Perception on Cognitive Learning Objective

The statistical analysis results (**Table 3**) on the questionnaires' answers showed a positive result. Students perceive that learning by using modified CBM with a team-based approach has improved learning at almost all levels of Bloom's hierarchy.

This is in line with the findings of [8] in a Neuroscience class that used team-based learning. Consistent group interaction through discussion provides continuous feedback to students. This helps students to understand the material, correct misunderstandings and logical errors. Intense interaction also helps to create learning motivation and a sense of belonging, enhancing teamwork.

3.3. Evaluation of Student Participation

The average student participation in group discussion activities is at the level of more than 90% (**Table 4**).

Table 2. Statistical Analysis of Student Score in Pre-Test and Mid Test

	N	Mean	Min	Max	SD	p-value
Pre-Test	100	68.32	13.05	86.95	12.88	0.75
Mid-Test	100	74.30	50	90	7	
t-test: NS						

Table 3. Statistical Analysis of Student Perception on Cognitive Learning Objective

	N	Mean	SD	p-value
Gain Knowledge	103	4.54	0.35	<0.001
Understand	103	4.30	0.55	<0.001
Apply	103	4.23	0.57	<0.001
Analyze	103	4.41	0.49	<0.001
Synthesize	103	4.51	0.37	<0.001
Inquire	103	4.63	0.35	<0.001
Evaluate	103	4.35	0.41	<0.001
Oral expression	103	4.34	0.46	<0.001
Written expression	103	4.15	0.79	<0.001

Table 4. The average of student participation in group discussion

No	Forum	N*	n[#]	Participation (%)
1	Discussion of pre-test 1	102	9	91.18
2	Discussion of Case 1	102	7	93.14
3	Discussion of pre-test 2	102	3	97.06
4	Discussion of Case 2	102	4	96.08
5	Discussion of pre-test 3	102	5	95.10
6	Discussion of Case 3	102	9	91.18
7	Discussion of pre-test 4	102	3	97.06
8	Discussion of Case 4	102	5	95.10
9	Discussion of pre-test 5	102	3	97.06
10	Discussion of Case 5	102	8	92.16
11	Discussion of pre-test 6	102	5	95.10
12	Discussion of Case 6	102	8	92.16
13	Discussion of pre-test 7	102	4	96.08
14	Discussion of Case 7	102	4	96.08

*Sum of Students

#Sum of inactive students in discussion

The large participation is due to the score point that directs students to participate in discussion activities actively. These results align with findings [6] in the Biology class. Persuading participation with score points motivates students to take part in every activity prepared for active learning

4. CONCLUSIONS

1. Active learning using modified CBM with a team-based approach has no significant effect on the average score of the exam populated with questions in recall and understanding concept or Bloom's taxonomy level 1 and 2. Further

research is needed to examine the effect of this learning method on students' ability to answer questions at levels 3 and 4 of Bloom's Taxonomy.

2. Student perceptions of the use of this learning method showed positive results. Students agree that this learning method helps them learn high-order thinking skills (HOTS), the main goal of active learning.
3. Student participation in discussion activities is more than 90%, motivated by score points. Further research is needed on student participation if asked to participate voluntarily.

ACKNOWLEDGMENTS

The author would like to thank all the students, participants of the General Microbiology THP course of 2021. The author also would like to express the deepest gratitude to financial assistance from LP3M Andalas University in the form of a Class Action Research Grant.

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