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Case-Based Learning Method in Intelligent System Course

Nefy Puteri Novani[1*] , Desta Yolanda[1]

[1] *Universitas Andalas, Indonesia*
*Corresponding author. Email: nefyputeri@it.unand.ac.id

ABSTRACT
The learning method discussed in this study is a case-based method implemented in the Intelligent Systems course. Activities in this research include action planning and compiling teaching materials in the form of cases scenarios/problems that students find solutions to in small groups. In its implementation, students were given cases that should be solved in groups of students. It encourages students to get a higher order of thinking skill level because real problems require problem-solving together by using information for problem-solving with different perspectives and with various strategies that group members can suggest. Students' test scores were collected by giving an evaluation test for Fuzzy Logic topics and Neural Network topics. The results showed that 63% of the students achieved the maximum point from the evaluation test.

Keywords: *Case-Based method, Learning Method, Case-based Learning Method, High Order Thinking.*

1. INTRODUCTION

The Intelligent Systems course in the Computer Engineering Department curriculum is designed to meet the demands of professionals from the industry with the application of intelligent devices, especially in embedded system devices for production and healthcare. The importance of mastery of intelligent systems and artificial intelligence is closely related to how higher education service providers prepare graduates to analyze, design, and develop intelligent devices on a small to large scale by applying computer engineering, embedded systems, and related other sciences.

The targeted learning outcomes of this Intelligent Systems course are that students can understand lifelong learning needs, including access to knowledge related to currently relevant issues. Students are also targeted to effective communication in working across disciplines to solve artificial intelligence problems. Problems in developing intelligent systems or devices are related to the integration of data used in artificial intelligence and big data, which is an integral component of the Industrial Revolution 4.0 era. The hope is that this Intelligent Systems course can motivate students to apply loglife learning because the ability to formulate problems, find solutions, and create a knowledge base is very useful in input data for artificial intelligence and Big Data applications.

The existence of a paradigm shift in the implementation of learning encourages lecturers to continue development in learning methods more creatively and innovatively in presenting lecture material. To produce productive, creative, and innovative graduates, this can be realized through the implementation of learning that can be carried out in various scopes by using critical and creative thinking skills. Learning can be applied by empowering Higher Order of Thinking Skills (HOTS).

HOTS [1] is critical in applying, linking, and modifying existing knowledge to effectively solve new issues (Thomas & Thome, 2009). Higher-Order of Thinking Skill is the ability to think critically, logically, reflectively, metacognitively, and creatively which is a higher-order thinking ability. HOTS requires the ability to remember and requires higher abilities, such as thinking creatively and critically. Higher-order thinking necessitates applying new information or knowledge that has already been learned and manipulating that information to obtain the ability to respond in new situations. Bloom's thinking skills are divided into two categories; low-level thinking skills, which are knowledge, understanding, and application, and high-level thinking skills, which are made up of knowledge, understanding, and application. Analysis, synthesis, and evaluation are examples of advanced thinking skills [1].

The application of the case-based learning method is an opportunity for lecturers to implement learning at the HOTS level. The case-based learning method is discussion-based participatory learning to solve clinical and non-clinical cases or problems driven by real-life problems (Schmidt, 2000) [2]. Applying this method will hone and improve the skills of formulating problems, analyzing arguments and data, defining concepts, critical thinking to determine conclusions, and using the information to solve problems, communication skills, collaboration, and creativity. Through conversation and contemplation in group discussion and decision-making, students are motivated to integrate their prior experiences to assess cases and discover answers [2]. Thus, implementing the case-based method in the Intelligent System class will significantly benefit both lecturers and students.

1.1. Case-based Method

The case-based method (CBM) is a learning method that requires students to actively participate in real problem situations, which reflect the type of experience in the discipline being studied [3]. In [4,5,6] it was explained that the CBM was effective and positively impacted motivating study participants/students to improve their knowledge and skills in identifying the problems they found. The application of the CBM in learning encourages students to be actively creative in groups. It is more effective in increasing student creativity in developing an attitude of working together in groups through the learning process to achieve maximum learning outcomes [7,8]. In the implementation of CBM, lecturers create scenarios to develop knowledge reasoning and students' skills in defining, formulating, analyzing, and finding solutions for that case/problem. This case-based learning method allows students to have critical thinking skills to analyze first and encourages students to search for knowledge domains that are relevant to the problems given in the case/problems.

There are several characteristics of the case-based learning method [9] :

a. Case: an educational instrument that appears in the form of a narrative. The narrative brings real-life situations into the class. A good case's characteristics include having a good idea, focusing on something controversial, something new/trending for students, creating empathy with a central character, and being brief.

b. Study Questions: contains a list of study questions presented at the end of each case. Study questions encourage student understanding because they encourage them to find out first and then apply what they know in analyzing the data and proposing solutions rather than just remembering facts, names, labels, formulas, definitions, etc.

c. Small-Group Work: Students discuss their responses to study questions in small study groups. Students have the opportunity to discuss cases and questions with each other before the whole class discussion.

d. Group Discussion: requires the active involvement of students in learning activities. Lecturers manage the discussion period so that students can critically analyze real cases by letting students find out their food independently rather than injecting meaning from one material to be taught.

e. Follow-Up Activities: with class discussions, students are encouraged to know more to be motivated to read a lot and learn a lot.

The target of the application of CBM in learning is that students can apply theory in real contexts, think critically about complex situations, choose actions that must be taken, develop self-knowledge, compare and evaluate self-perspectives and the perspectives of others [10]. CBM also bridges theory and practice to gain experience in complex learning [11].

1.2. Our Contribution

This Research Activity for Development and Quality Assurance of Education contributes to the increasing learning outcomes. For students, this study can develop higher-order thinking skills (HOTS) in finding solutions for any real case or problems encountered during the learning process. For lecturers, this study can be used as a development in the next learning process that will be carried out based on existing improvement notes.

2. METHODS

This study was conducted on 8 students of the System Intelligent class in the Computer Engineering Department Universitas Andalas. Student's test score from the evaluation was collected for this study to find out how successfully the case-based learning method
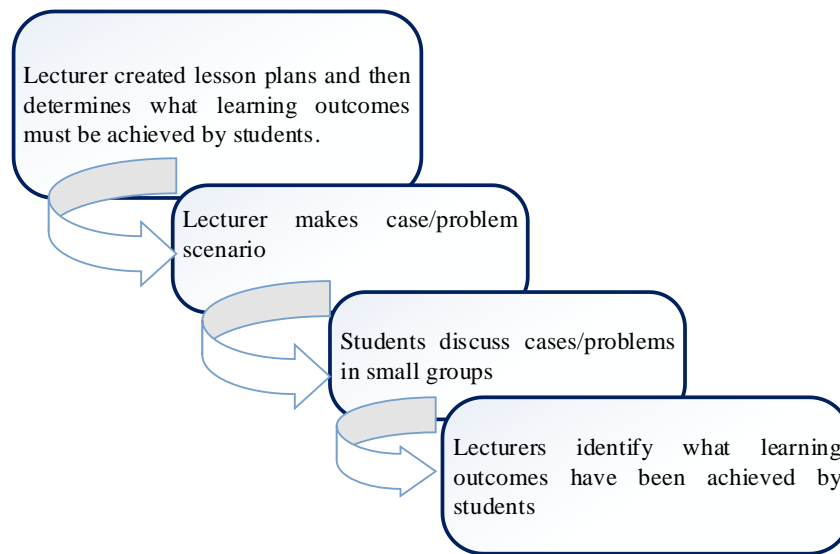
Figure 1 Procedure of the Case-based Method Implementation

was applied. Lecturers conducted this study provided case scenarios for two topics. Explanation of the methods applied in the implementation of CBM is explained chronologically.

2.1. Study Design

This study was planned within a period of one semester during the odd semester of the 2021/2022 academic year based on the Universitas Andalas Academic Calendar (Augustus-December 2021) with the details of the planned set of activities set as follows:

1) Action planning; lecturers prepare lessons plans and case scenarios for topics.

2) The implementation of action planning followed by observation activities

3) Interpretation and analysis, and follow-up plans.

The learning method applied in improving learning in the Intelligent Systems course is the case-based method. This learning method is expected to affect activities, knowledge, skills, critical thinking aspects, and student learning outcomes in learning. It is also expected that it will give students the freedom to determine their learning sequence to create an independent, cross-disciplinary learning culture and gain valuable knowledge and experience to apply. Assessment includes assessing processes and outcomes, with selecting assessment techniques

following the level of competence planned in the lessons plans.

2.2. Data Collection and Analysis

The data collected in this study was the student test scores, lessons plans, and a collection of case scenarios or problems by the lecturers.

2.3. Performance Indicator

The indicators used to see the effectiveness of the implementation of CBM in this study were the learning outcomes and students' test scores for Fuzzy Logic topics and Neural Network topics. Learning outcomes were measured by student activity during group discussion and the accuracy in formulating problems from cases/problems given by lecturers and finding solutions for those cases in small groups so that students could get experience for critical thinking analytical thinking to achieve HOTS. The criteria for the effectiveness of the implementation of CBM are if more than 60% of the students reach maximum points.

3. RESULTS AND DISCUSSION

The study was conducted in the Intelligent Systems course as described in Figure 1. First, lecturers created revisions to the lessons plans for developing learning methods and assessments to be more effective in facilitating students to achieve the learning outcomes. From a meta-analysis of various forms of learning (LP3M Unand, 2014), group learning is considered

more effective in accelerating academic achievement, more suitable to form the desired attitude in a learning outcome, and further enhances the persistence of the course material being studied. Implementation of action planning followed by development and observation is done by analyzing the problems faced by implementing learning methods and student assessments in the previous class or previous lessons plans. Lectures created two case scenarios for Fuzzy Logic topics and Neural Network topics in class. Then, case-based learning is carried out by combining a cooperative learning approach and students' critical thinking in analyzing the cases or problems given.

3.1. Students Test Scores Results

Students' test scores were collected by giving an evaluation test for Fuzzy Logic topics and Neural Network topics. The results showed that 63% of the students can achieve the maximum point from the evaluation test. Based on these results, it can be concluded that the application of the CBM learning method is optimal to be applied to the Intelligent Systems class with less than 10 participants.

This study will continue to be applied throughout the lecture period in the odd semester of 2021/2022 to obtain a more comprehensive final analysis. So, we are very open if there are any inputs and suggestions for this research in the future.

4. CONCLUSION

This study described implementing the case-based learning method (CBM) in the Intelligent Systems class, starting with Action Planning. Based on test scores from the evaluation to students, it is considered effective for the class with fewer than 10 participants.

ACKNOWLEDGMENTS

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