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# Implementation of Case-Based Method (CBM) Learning Model under OBE paradigm in the Electromagnetic Field Course

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**Abstrak**

This paper evaluates the implementation of the Case-Based Learning Model (CBM) in the Electromagnetic Field course under the Outcome-Based Education (OBE) approach in the undergraduate Electrical Engineering program at Universitas Andalas (Unand). CBM, involving students in case analysis, is integrated into OBE to achieve desired learning outcomes. Evaluation is conducted through attendance, mid-term exams (UTS), final exams (UAS), and case study reports. The analysis of student grades shows satisfactory class performance but with significant variability. Improvement focus is recommended on enhancing conceptual understanding, especially prior to UTS and UAS. By focusing on strengthening conceptual understanding and intervening with low-performing students, this model can continue to enhance the quality of learning in the Electromagnetic Field course. This evaluation provides in-depth insights into individual achievements and class dynamics overall. In conclusion, the implementation of CBM in Electromagnetic Field within the OBE framework provides opportunities to produce graduates with relevant theoretical knowledge and practical skills.

**Kata Kunci**: *Outcome based education, Cased-based Method, Electromagnetics field, learning outcome enhancement.*

## Introduction

Education is the foundation for preparing the younger generation to face the future challenges. In this globalization era, the demands on the education system are becoming more complex, requiring a more holistic and relevant approach. Outcome-Based Education (OBE) has gained widespread attention as an educational paradigm that focuses on the desired outcomes of the learning process [1]. OBE is not just a teaching method but an educational philosophy that emphasizes students' abilities and achievements. In other words, OBE seeks to create a balance between the learning-teaching process and the expected outcomes. This approach emphasizes the importance of measuring education success through students' actual achievements in mastering specific skills and knowledge [2]. A comprehensive understanding of OBE is expected to provide clearer insights into how we can design an education system that is responsive, adaptive, and relevant to the dynamics of change in the global education landscape.

Electromagnetic Field (EMF) is one of the core courses in the undergraduate Electrical Engineering program at Andalas University (Unand). The implementation of OBE in this course aims to produce graduates who not only have a theoretical understanding of electromagnetic fields but can also apply that knowledge in real-world contexts. The implementation of OBE in the Electromagnetic Field course not only enhances the quality of education but also ensures that graduates have skills and knowledge relevant to industry demands and technological developments.

The implementation of OBE in the Electromagnetic Field course in the Electrical Engineering program at Unand uses the Case-Based Learning model (CBM). The use of real cases in the CBM learning model allows students to apply their theoretical knowledge in the context of concrete situations [3]. The use of the CBM learning model places students as the primary agents of learning by involving them in case analysis, problem-solving, and solution presentation [4]. The role of the lecturer in the Case-Based Learning model (CBM) in the Electromagnetic Field course is crucial to ensure the success of the learning process through lesson planning, concept introduction, mentoring and guidance, facilitating the exchange of ideas and solutions, monitoring, and conducting learning process evaluations [5-7].

This model demands active participation from each student in small groups to discuss and analyze case studies, enrich knowledge, formulate solutions, and exchange ideas and perspectives. This model differs from traditional teaching models where lecturers dominate content delivery, and students are more passive. Therefore, the question to be answered is how do students perform in the Electromagnetic Field course in the Electrical Engineering program at Unand after the implementation of OBE based on CBM?

## Method

The evaluation of the CBM learning model is crucial to assess its success and effectiveness in the educational context. In the context of electromagnetic field lectures in the undergraduate Electrical Engineering program at Unand, evaluation or assessment is carried out to assess the achievement of course learning outcomes (CPMK). The CPMK for the electromagnetic field course are as follows:

1. Students can comply with regulations regarding the number of attendances (i, S8).
2. Students understand and can demonstrate problems regarding the static electric fields (a, P2).
3. Students understand and can demonstrate problems regarding the steady magnetic fields (a, P2).
4. Students can explain the Poisson, Laplace, and Maxwell equations (a, P2).
5. Students can communicate within and outside the team with spoken and written abilties (f. KK6).

The methods used to assess learning outcomes include attendance assessment, mid-term exams (UTS), final exams (UAS), presentations, and case study reports, as shown in Table 1.

A. Attendance

Universitas Andalas's Rector Regulation requires each student to attend lectures for each programmed course at least 75% of the total class meetings conducted. Student attendance in the learning process is seen as compliance with regulations and is an essential element in determining their final grade. The attendance is used to assesses CPMK-1, and

the contribution of the attendance grade to the final course grade is 10%.

B. Mid-term Exam (UTS)

The assessment of learning outcomes (CPMK) through mid-term examinations plays a crucial role in evaluating students' understanding and knowledge acquisition during a course. Mid-term examinations serve as a strategic checkpoint, allowing educators to gauge students' grasp of key concepts and skills at a midpoint in the academic term. These assessments typically cover a range of topics taught up to that point and provide insights into individual and collective academic progress. The results obtained from mid-term examinations not only contribute to students' overall grades but also offer valuable feedback to both educators and learners. This feedback loop facilitates targeted interventions, such as additional support for struggling students or adjustments to teaching methods if widespread challenges are identified. Overall, mid-term examinations are integral components of the educational assessment process, fostering continuous improvement in teaching and learning strategies. For Electromagnetics field course, the UTS assesses the CPMK-2 with the contribution to the overall grade is 35%.

C. Final Exam (UAS)

The assessment of learning outcomes through final examinations (UAS) represents a culmination of students' academic achievements over the entire course. Final examinations are comprehensive evaluations that assess students' understanding, retention, and application of the course material. These assessments cover a broad spectrum of topics, reinforcing the retention of knowledge acquired throughout the term. Final exams are designed to be rigorous, testing students' ability to synthesize information, analyze concepts, and demonstrate a mastery of the subject matter. The results obtained from final examinations carry significant weight in determining students' overall grades, reflecting their proficiency in the course. Moreover, final exams provide a holistic view of individual and collective academic performance, offering insights into the effectiveness of the instructional methods employed throughout the term. This comprehensive assessment fosters accountability, as students are expected to showcase their cumulative learning achievements, and it serves as a benchmark for educators to evaluate the success of their teaching strategies. For Electromagnetics field course, the UAS assesses the CPMK-3 and CPMK-4 with the contribution to the overall grade are 20 and 5%, respectively.

D. Case Study Report

The assessment of learning outcomes through case study reports and presentations is a dynamic and interactive approach that goes beyond traditional examinations. This method allows students to apply theoretical knowledge to real-world scenarios, fostering a deeper understanding of the subject matter. Case study reports require students to critically analyze and solve complex problems, demonstrating their ability to synthesize information and make informed decisions. The accompanying presentations further enhance the assessment process by requiring students to articulate their findings, solutions, and insights in a coherent and engaging manner. This multifaceted assessment method not only evaluates the application of theoretical concepts but also hones students' communication and presentation skills. It provides a platform for students to showcase their analytical thinking,

problem-solving capabilities, and the practical relevance of their academic learning. The assessment of learning outcomes through case study reports and presentations offers a holistic perspective on students' academic achievements, emphasizing not only what they know but how effectively they communicate their knowledge.

Case study reports are done in groups, discussed among group members, and presented in the classroom. This report contains the solution to the given case, accompanied by supporting theories. The report assesses CPMK-5, with a contribution of 30% to the final course grade. Table 1 shows CPMK, assessment methods, and the percentage contribution of each CPMK to the learning outcomes.

Table 1. Assessment Plan for CPMK in Electromagnetic Field Course

| CPMK | Percentage Contribution of Assessment | | | | | |
|---|---|---|---|---|---|---|
| | Attendance | UTS | UAS | Assignment | | Total |
| | | | | Presentation | Report | |
| CPMK-1 | 10 | | | | | 10 |
| CPMK-2 | | 35 | | | | 35 |
| CPMK-3 | | | 20 | | | 20 |
| CPMK-4 | | | 5 | | | 5 |
| CPMK-5 | | | | 10 | 20 | 30 |
| Total | 10 | 35 | 25 | 10 | 20 | 100 |

**Results and Discussion**

This paper discusses the evaluation in class A, one of the four classes of the electromagnetic field course in the first semester of 2022-2023 academic calender. The results are shown in Table 2.

Table 2 provides an in-depth overview of student performance in the Electromagnetic Field course through various assessment components. The average percentage student attendance reaches 82.5, indicating a relatively high level of participation. Meanwhile, Assignment 1 and Assignment 2 scores reach averages of 75.0 and 76.8, indicating a good understanding of structured assignments. However, the average scores for mid-term exams (UTS) and final exams (UAS) are slightly below standard, with 49.4 and 50.1, respectively, indicating potential challenges in understanding the basic concepts of the course.

Table 2. Student grade

| No | NIM | CPMK 1 | CPMK 2 | | CPMK 3 | CPMK 4 | CPMK 5 |
|---|---|---|---|---|---|---|---|
| | | CP I | CP A | | CP A | CP A | CP F |
| | | Kehadiran | Tugas 1 | UTS | UAS | Tugas 2 | Presentasi |
| | | 10 | 10 | 35 | 25 | 10 | 10 |
| 1 | 2010952043 | 100.0 | 95 | 80 | 72.0 | 92 | 80 |
| 2 | 2110951024 | 100.0 | 90 | 70 | 49.0 | 92 | 80 |
| 3 | 2110951035 | 100.0 | 85 | 60 | 65.0 | 92 | 80 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | 2110951036 | 100.0 | 85 | 60 | 75.0 | 92 | 80 |
| 5 | 2110951040 | 81.3 | 60 | 30 | 55.0 | 80 | 80 |
| 6 | 2110951041 | 93.8 | 85 | 65 | 54.0 | 80 | 80 |
| 7 | 2110951042 | 100.0 | 85 | 60 | 39.0 | 80 | 80 |
| 8 | 2110951046 | 100.0 | 85 | 80 | 68.0 | 80 | 80 |
| 9 | 2110952004 | 87.5 | 65 | 40 | 45.0 | 80 | 80 |
| 10 | 2110952039 | 93.8 | 65 | 40 | 79.0 | 80 | 80 |
| 11 | 2110952041 | 100.0 | 70 | 45 | 45.0 | 80 | 80 |
| 12 | 2110952046 | 93.8 | 95 | 70 | 45.8 | 80 | 80 |
| 13 | 2110952048 | 100.0 | 95 | 80 | 61.0 | 80 | 80 |
| 14 | 2110952053 | 93.8 | 65 | 30 | 35.0 | 75.7 | 80 |
| 15 | 2110953001 | 100.0 | 60 | 30 | 35.0 | 75.7 | 80 |
| 16 | 2110953006 | 87.5 | 70 | 40 | 30.0 | 75.7 | 80 |
| 17 | 2110953007 | 87.5 | 70 | 40 | 43.0 | 68 | 80 |
| 18 | 2110953015 | 93.8 | 95 | 75 | 68.0 | 68 | 80 |
| 19 | 2110953022 | 87.5 | 65 | 40 | 30.0 | 68 | 80 |
| 20 | 2110953023 | 100.0 | 95 | 80 | 70.0 | 83 | 80 |
| 21 | 2110953028 | 37.5 | 65 | 40 | 0.0 | 83 | 80 |
| 22 | 2110953033 | 100.0 | 65 | 30 | 71.0 | 83 | 80 |
| 23 | 2110953035 | 87.5 | 70 | 40 | 30.0 | 83 | 80 |

The achievement of graduate learning outcomes (CPL or at the faculty level called CP) is analyzed by looking at the percentage achievement of each CP. The average percentage achievement of CP I reaches 90.2%, indicating a good focus on the core concepts of the course. The achievements of CP A and CP F have comparable percentages, indicating a balance in understanding additional concepts.

The range of values for each Course Learning Outcome (CPMK) in Electromagnetic Field reflects significant variation. Student attendance shows a high level of compliance, with a range of values between 37.5 and 100.0 and an average score of about 93.0. In the first assignment (CPMK 2), students show a good understanding with a range of values between 60.0 and 95.0 and an average score of about 79.3. However, there is variation in understanding the basic concepts of the course in the mid-term exam (CPMK 3) with a range of values between 30.0 and 80.0 and an average score of about 57.9. In the final exam (CPMK 4), there is potential challenge with a range of values between 0.0 and 75.0 and an average score of about 53.3. The ability of students in group assignments and presentations (CPMK 5) shows positive results, with a range of values between 68.0 and 92.0 and an average score of about 78.1. Overall, the total scores indicate a satisfactory class with a range of values between 52.7 and 82.5 and an average score of about 75.7.

The average score of 75.7 is equivalent to the lowest limit of the "A-" grade range (75 < A- <80). However, the relatively high standard deviation (22.6) reflects a significant level of variability in student achievement. The analysis of student grade trends shows that 8 students received good grades, while 6 students fell into the less satisfactory category. This provides an overview of different behavior in student responses to the learning material.

For improvement, several key points need to be considered. A more intense focus on understanding core concepts,

especially in preparation for UTS and UAS, can be an effective strategy. Specific interventions for students with low grades, including identifying learning barriers, will support their performance improvement. Proactive monitoring of student attendance and participation is also an essential aspect to ensure optimal engagement in learning and can enhance the quality of learning in the Electromagnetic Field course.

## Conclusion

Evaluation of the application of the Case-Based Learning Model (CBM) in the Electromagnetic Field Course using the Outcome-Based Education (OBE) approach in the Unand Electrical Engineering Department Undergraduate study program has been discussed. CBM, which involves students in case analysis, is integrated in OBE to achieve targeted learning outcomes. The role of lecturers in supporting student activities is crucial. Evaluation is carried out through attendance, UTS, UAS, and case study reports. Analysis of student grades shows adequate class performance with an average grade of 75.5, which is equivalent to an "A-" grade. However, the variation in grades among students is still quite high as indicated by a standard deviation value of 22.6. The focus of improvement involves increasing understanding of concepts, especially ahead of UTS and UAS, as well as intervention for students with low grades. Thus, the application of CBM to Electromagnetic Fields within the OBE framework provides an opportunity to continuously improve the quality of learning, producing graduates with relevant theoretical knowledge and practical skills.

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## Billiography

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