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Implementation of Multiple Representation Tests in The Evaluation of Electronics Courses

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ABSTRACT

Learning evaluation is a process of measuring and assessing the learning process, in this case, the lecturer measures and assesses students using test instruments. Research on multiple representation-based assessments has been carried out to evaluate electronics courses. The purpose of this study is to present the evaluation results using multiple representation-based assessments in the electronic learning process. This study uses a quantitative approach with a descriptive method. The data sources in this study were physics education students, FKIP UHAMKA. The data collection technique was carried out using a test technique with multiple representation test instruments. The data analysis technique used quantitative descriptive analysis. Testing the effectiveness of the representation test is done through the calculation of the gain score (N-gain). The results of data analysis in this study indicate that the application of multiple representation tests is more effective in determining students' representational abilities on transistor material through verbal formats, mathematical formats, graphic formats, and image formats.

Introduction

Electronics is the part of physics that studies semiconductors and related circuits, such as OP-Amps. A good understanding of the concepts of electricity and magnetism will make it easier for students to learn a branch of physics such as electronics. Based on the results of interviews with students, it was found that students still had difficulties in understanding the concept of electronics. Docktor & Mestre (2014) stated that the cause of students' difficulties in understanding a concept was due to misconceptions (conceptual understanding) of previous concepts, fragmented knowledge structures, and errors when making the ontology category of a concept.

The results of interviews with students indicate that attention is needed in learning electronics to direct students to understand the concept comprehensively. A lecturer needs to present electronic learning in various representation formats (Bollen et al., 2016). Several attempts have been made to overcome students' difficulties in understanding electronic problems through various representations. Examples of this method include giving assignments and quizzes of mathematical representations, pictures, graphics, and verbal (Kohl et al., 2007).

The learning process must be able to direct students to understand the concepts of electronics well. This process can be done through multi-representational learning which can train students' ability to understand and explain a concept verbally, graphically, diagrammatically, and mathematically. Fredlund et al. (2015) through their research, found that a multi-representation approach can improve learning outcomes at the same time. Other studies also reveal that multi-representation learning has succeeded in overcoming students' difficulties in understanding a concept (Abdurrahman et al., 2015;

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Widianingtiyas et al., 2015; Halim & Hasbullah, 2020). This success is due to multi-representation learning that not only emphasizes qualitative analysis but also includes quantitative procedures (Siprianus L Angin, n.d.). In addition, multiple representations can help students to explain phenomena and solve problems physically (Ainsworth, 1999).

Learning evaluation has an important role in learning activities. Through evaluation, lecturers can find out the success of students in participating in teaching and learning activities. Learning evaluation is a process of measuring and assessing learning activities, which are carried out using test instruments. Students have different abilities from each other in representing a concept. The use of various types of representations in teaching materials and assessment instruments can help teachers as well as students to identify the most superior type of intelligence possessed by students. Learning that is dominated by a lack of verbal explanation will make it easier for students to have multiple intelligences. Tests that are dominated by verbal forms are less able to provide challenges to students and do not optimize multiple intelligences. Therefore, to obtain more exposure to learning outcomes data, objective and in accordance with the learning applied to electronics courses, multiple representation tests were carried out. This research is important to do in order to contribute knowledge about the implementation of evaluation in the form of multiple representation tests.

Methods

This study uses a quantitative approach with a descriptive method. The sample used in this study consisted of 20 physics education students from FKIP UHAMKA. The technique of collecting data is using a test technique, with multiple representations. The data analysis technique used N-gain analysis to determine the student's representation ability.

Result and Discussions

Multi-representation is a model that represents the same concept in several different formats (Irwandani, 2014; Syahmel & Jumadi, 2019). This study analyzes the ability of verbal representation, pictures, mathematics, and graphics. The results of each student's representation ability are explained as follows:

1. The Ability to Comprehend Verbal Representation

Based on the results of data analysis regarding students' comprehension skills in the verbal question format, it is known that the average value of students has increased, from 10,625 to 14.75 with an N gain of 0.44. Students' ability to understand the format of verbal questions is reviewed based on classification skills and drawing conclusions skills. Students have problems with verbal representation, in giving reasons for each question. In addition, students are still not able to make conclusions well.

The results showed that the average post-test score of students experienced an increase in verbal format reinforcement which was included in the medium category. This result is slightly different from Halim & Hasbullah (2020) whose research showed the average ability of students to understand verbal questions was still low, especially in summarizing skills.

2. The Ability to Comprehend Picture Representation

Based on the results of the data analysis of students' understanding abilities on image format questions, it is known that the average value of pretest to post-test has increased, from 9.3 to 15.175 with N gain of 0.549; so it can be said that the average value of students has increased in the medium category. Students have difficulty in analyzing pictures of bipolar junction transistor circuits on a question related to verbal representation skills. This is because students have not been able to develop skills in classifying images, causing difficulties in representing graphs in mathematical form. This result is in line with the findings of (Masrifah et al. (2020) and Dimas et al. (2018) who said that low image representation was caused by students being too focused on doing math, verbal, and graphic problems.

3. The Ability to Comprehend Mathematical Representations

Based on the results of the data analysis of students' ability to understand the format of mathematical questions, it is known that the average value of the pretest to the posttest has increased, from 9.175 to 14.375 with an N gain of 0.48. Students are used to memorizing equations or formulas and symbols for certain quantities. This can be seen from the mathematical ability of students in working on test questions. Students assume that electronic material is still literature with formulas. The results of the pretest and posttest showed that the increase in the average score was good, with a moderate gain.

4. The Ability to Comprehend Graph Representations

Based on the results of the data analysis of students' understanding ability in the verbal question format, it was obtained that the average score

increased from pretest to post-test, with an N gain of 0.642. The pre-test data showed that the students' initial ability in graphic skills was very low. The average pretest score of students was 5.6 from a maximum score of 20. The low ability of students to represent graphics was caused by students not receiving graphic information in the previous lesson. The material transistors are materials that contain a lot of graphic information. This is in line with the opinion of (Purwanti et al. (2016) who states that errors in the retrieval of graphic information can have a very fatal impact. Therefore, students' understanding of graphs regarding multi-representation in learning, especially transistor material is very important, as important as multi-representation functions are useful for developing deeper student understanding (Ainsworth, 1999; Erniwati et al., 2020; Nulhaq & Setiawan, 2016; Opfermann et al., 2017).

Conclusions

Based on the results of data analysis, students' multiple representation abilities increased in the medium category. Students' representation ability on transistor material in verbal format obtained N gain of 0.44; the mathematical format of 0.48; as well as graphic formats and image formats of 0.642 and 0.549, respectively. The highest posttest average value of students is in the picture format category, while the other three formats are still rated low even though the difference is not too far. Based on the results of the study, it can be concluded that the application of the use of multiple representation tests is effective to determine students' representational abilities on transistor material through verbal formats, mathematical formats, graphic formats, and image formats.

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