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Application of Multimedia Learning Modules assisted by “Tracker” Virtual Laboratory to Train Verbal Representation of Class XI High School Students

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Abstract. This study aims to determine the application of multimedia learning modules assisted by tracker virtual laboratory (virlab) to train the verbal representation of students in class XI. This study uses observation and documentation methods to collect data. Observation instruments in the form of assessment sheets used to assess the level of representation students by using 2 classes where each class is filled by different educators. The first class is class XI IPA 1 (modelling class) and the second class is class XI IPA 2 (implementation class). The ability of verbal representations of students is assessed based on indicators on the assessment sheet. The results of the analysis show that verbal representation skills based on indicators clearly explain the problem, the ability to express opinions in sentence form, and describe definitions and terms of a concept in the implementation class obtain results that are better than the modelling classes. Whereas, the fourth indicator is explaining the results of the graph in the form of verbal representations in the modelling class obtained results that are better than the implementation class. These results indicate that application of multimedia learning modules assisted by tracker virlab application can be used to train verbal representation skills.

Keywords: Multimedia learning modules; Tracker; Verbal representation.

1. Introduction

Current technological developments are very fast, including in Indonesia, especially the development of mobile learning [1]. The learning process requires a good communication process in the form of delivering ideas or knowledge from educators to students. This condition is strongly influenced by the role of educators in conducting stimulus to students. Students are directed to be actively involved during the learning process in the classroom to create effective learning. There is a need for an educator's role in constructing each learning material so as to facilitate students in learning to understand, communicate and perform simulations as the end of learning objectives [2].

Learning is said to be successful if students are able to understand the concept of the material well [3]. Physics learning is one of the main branches of natural science that discusses aspects that can be observed directly or through the help of tools or media. The data obtained through the observation process can be analysed so that it has a certain meaning or understanding. At present observations can be made through very complex instruments, which contain many elements of theorists. The use of



instruments in learning shows how closely the relationship between theory and empirical data is closely related [4].

There are still many students who think that physics is a very abstract material to understand. Understanding physical concepts that are wrong happens to students, this requires students to have problem solving skills. Problem solving is a major component in learning. He also stated that the main problem solving is if students already have the ability to categorize, verbal ability, self-diagnosis, ability to translate diagrams, ability to translate graphs, ability of mathematical equations or application of symbols, and good analogy abilities [2]. In accordance with the problems in the physics material, then to practice problem solving skills, there needs to be an application of a learning media to train students' verbal representation abilities.

The multimedia learning environment combines many sources of information (e.g., text, diagrams, and simulations) to help students master cognitively challenging learning. The purpose of getting benefits from multimedia learning is that students need to make connections between these sources of information. One strategy is to encourage students to think deeply and cognitively, and to engage with self-explanatory learning materials [5]. Multimedia learning places students in learning activities whose purpose is to empower all the brain activities of the students themselves [6]. The implementation of online pre-lecture learning modules in physics learning results in increased learning acquisition on conceptual and representational reasoning tests. The module has advantages in addition to regular course instruction, an increase in conceptual understanding and representational abilities of learners greater than regular learning [7].

Multimedia learning modules as an introduction to learning that aims so that students have an initial understanding before learning, as well as multimedia learning modules designed in many forms of multimedia presentations such as animated videos and audio packaged in representation [8]. Multimedia learning modules can positively influence students' learning concepts and improve their classroom performance, and can be accessed from anywhere at any time. The attitude of students about multimedia learning modules is very positive. Students enjoy flexibility related to online learning material, easy to use, very effective in helping to study physics [9]. The advantages of multimedia learning modules include 1) the use of media on learning, as well as efficient and effective development, 2) reliable, 3) can be maintained or managed easily, 4) easy to use and simple in operation, and 5) programs on the media learning can be reused in developing other learning media [10]. In exploring learning models using visual, verbal, and multimedia learning modules are preferred by students, by adding more modules with visual components that can make learning more enjoyable [11].

This study investigates the application of multimedia learning modules assisted by tracker virlab as learning material before learning to train students' verbal representation skills. In this article, we first introduce the contents of multimedia learning modules and their potential pedagogical advantages. We then describe the details of the controlled study design and compare the data in the tests for the modelling class group (XI IPA 1) and the implementation class group (XI IPA 2) to train students' verbal representation skills. Then we evaluate the application of multimedia learning modules assisted by tracker virlab to train students' verbal representation abilities. In addition, we present some students' perceptions and feedback about multimedia learning modules. We conclude by presenting some of the implications of this study.

The rest of this paper is organized as follow: Section 2 presents literature review. Section 3 describes the proposed research method. Section 4 presents the obtained results and following by discussion. Finally Section 5 concludes this work.

2. Related Works

This section presents review on existing literatures.

2.1. Multimedia

Multimedia as a medium for the development, merging, and distribution of several texts, animations, images, sounds or videos on digital devices [12-14]. The meaning of multimedia is a combination of

several media such as images, text, graphics, animation, sound, video and the interaction that is presented in the form of digital (computerized) and comply four factors, namely 1) using a computer to coordinate features in it, 2) links between users and information accessed, 2) there is navigation as a control tool, 4) as a place for users to collect, process, and communicate information interactively [15].

Multimedia learning modules are made in the form of multimedia presentations in the form of graphic, text, video, narration, animation and audio features that are realized with various forms of representation [8-9] [11] [16-17]. Various forms of representation provided provide a positive impact in the form of wealth of information from the use of multimedia learning modules so as to make learning activities more effective, increase students' understanding and motivation [16] [18-19]. Multimedia learning modules are used as a learning tool to reduce the limited use of text books that are less effective where students only read books without taking more important information [8] [20].

2.2. *Tracker*

Tracker is a video analysis tool that is free to download and has a very short learning time to understand. By recording any movement, it's easy to use videos to track the movement of an object and generate a graph of distance time by calibrating the known distance on the screen, that is by including a ruler in the background of the video. On the Tracker website, there are a number of help files and there is a video tutorial provided by Douglas Brown, the maker of Tracker software. This is more than enough to guide users first through ordinary video analysis [21]. With this tool, users can track markers shown on video or on stroboscopic photos and perform kinematic analysis. Tracker also includes a data modelling tool that allows one to enter several theoretical equations into data obtained experimentally [22].

2.3. *Verbal Representation*

Verbal is a form of representation that plays an important role in problem solving [2]. Verbal skills needed in physics include understanding the definition, when discussing, composing sentences, communicating, interpreting, formulating conclusions, communicating conclusions [23]. Verbal ability is also one of the internal factors that can affect the high and low learning achievement of students. Good verbal skills possessed by students will be very supportive in the process and learning outcomes of the material to be taught. This can happen because students who have good verbal skills are thought to have skills that require familiarity with written and oral language to listen, examine the contents of a statement, dare to express ideas, ideas, opinions, and thoughts, so that students can take an appropriate conclusion [24]. Operational verbal representations of words or written texts, among others: making problem situations based on data or representations given, writing interpretations of a representation, writing down steps to solving mathematical problems with words, composing stories that correspond to a representation that is presented, answering the question using words or written text [25]. Verbal format aims to provide a definition of a concept, verbal is the right way to use [26]. Where verbal is the words that will be delivered to explain a learning. Indicators of verbal representation used are:

- a. Explain the problem in detail and clearly.
- b. Express opinions in sentences.
- c. Describe the definition and terms of a concept.
- d. Describe the results of mathematical representations, diagrams and graphics in the form of verbal representations.

3. **Research Method**

This study uses observation and documentation methods to collect data. The observation instrument is an assessment sheet used to assess the level of representation of students. Before conducting the research, the researcher first analyses the students, analyses the competency of the high school physics curriculum, analyses concepts and makes concept maps, arranges the planning stage, selects the model and learning media and designs a lesson plan. Student analysis includes age, level of cognitive development, and students' abilities. Competency Analysis of the High School Physics Curriculum refers to the 2013 Curriculum document. Material analysis is in the form of concept analysis which

includes facts, concepts, principles, laws, and theories. The material taken in this study is light waves in class XI High school.

This study uses two classes where each class is filled by different educators. The first class is class XI IPA 1 (modelling class) and the second class is class XI IPA 2 (implementation class). Students before participating in the learning process are first given multimedia learning modules. After the whole series of learning is completed, the results of the assessment of the verbal representation of students are completed. The grading of verbal representation is shown in Table 1.

Table 1. Grid assessment of verbal representation

No.	Assessment Aspect	Assessment Indicator	No. Item
1	Explain the problem in detail and clearly	Students can explain the problems found when the diffraction grid practice is detailed and clear	1
2	Express opinions in sentences	Students can express their opinions in answering problems about diffraction grating in sentence form	2
3	Describe the definition and terms of a concept	Students can describe the definitions and terms of the concept of diffraction grating	3
4	Describe the results of mathematical representations, diagrams and graphics in the form of verbal representations	Students can explain the results of mathematical representations, diagrams and graphics in the form of verbal representations	4

Data analysis techniques in this study use the analysis of the feasibility of lesson plan instruments and the assessment of verbal representation. The final value is obtained by the formula:

$$\text{Final value} = \frac{\sum \text{the score obtained}}{\sum \text{maximum score}} \times 100\% \quad (1)$$

Percentage of eligibility criteria:

Table 2. Product criteria

No.	Score Range (%)	Quality Category
1	$0 < \text{Final Value} \leq 25$	Very less
2	$25 < \text{Final Value} \leq 50$	Not good
3	$50 < \text{Final Value} \leq 75$	Good
4	$75 < \text{Final Value} \leq 100$	Very good

4. Results and Discussion

Lesson plan assessment refers to the scientific approach to learning physics of light wave material using modules. Assessment is carried out with the aim of knowing whether the drafted lesson plan has reflected the scientific approach. The lesson plan includes various aspects, namely the formulation of learning activities, the content presented, language and time. Expert assessment results are presented in table 3.

Table 3. Results of feasibility assessment of lesson plan

No.	Rated aspect	Score	Maximum Score
1	Formulation of Learning Objectives	3,4	4
2	Content Presented	3,6	4
3	Language	3	4
4	Time	4	4
Total score		14	16
Percentage (%)		87,5	

Lesson plan assessment results from aspects of formulating learning objectives obtained a score of 3.4; the contents presented obtained a score of 3.6; language obtained a score of 3; time obtained score 4. Based on table 3 it can be stated that lesson plan physics using the media module is categorized very well.

The ability of verbal representation was measured using an assessment sheet filled by observers. This assessment sheet aims to determine the ability of students' verbal representation. Previous assessment sheets have been validated by experts. Valuation of the verbal representation assessment instrument sheet covers various aspects, namely format clarity, systematics, scoring guidelines, language and assessment format. Expert assessment results are presented in table 4.

Table 4. Validation results of verbal representation assessment sheets

No	Rated aspect	Score	Maximum Score
1	Format clarity	4	4
2	Systematics	3	4
3	Scoring guidelines	4	4
4	Language	3	4
5	Assessment format	4	4
Total score		18	20
Percentage (%)		90	

The results of validation of verbal representation assessment sheets from aspects of the clarity of the format obtained a score of 4; systematics obtained a score of 3; scoring guidelines obtained a score of 4; language obtained a score of 3; assessment format obtained score 4. The results of expert validation obtain an assessment in the category of very good and feasible to be used in modelling and implementing learning without improvement. Validation results of the verbal representation sheet are then used to assess students' abilities.

Learning activities are preceded by distributing android-based learning devices in the form of modules. The modules that have been distributed are expected to be read and studied by students but when learning some students are still confused. This was overcome by a brief explanation of the material taught by the Teacher. The learning carried out went smoothly and simple practicum activities related to light diffraction material were carried out. Furthermore, the results of the practicum are presented in front of the class and an assessment is conducted to determine the students' verbal abilities.

The ability of students' verbal representation is determined based on an analysis of verbal ability assessment sheets. Based on the results of the analysis, obtained data as presents in Figures 1 and 2.

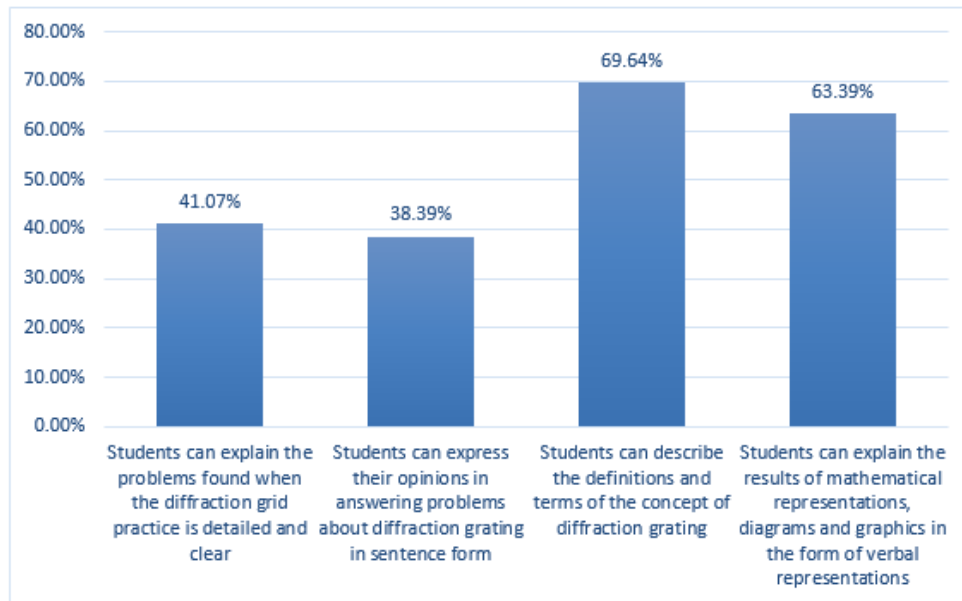


Figure 1. Verbal representation grade verbal representation modelling class

The ability of verbal representation of students is assessed based on indicators on the assessment sheet. The results of the analysis based on Figures 1 and 2 show that for verbal representation abilities based on the first indicator is to explain the problem clearly in the modelling class (XI IPA 1) obtained a percentage of 41.07% and the implementation class (XI IPA 2) obtained a percentage of 47.50%. In the second indicator, the ability to express opinions in the form of sentences in the modelling class gets a percentage of 38.39% and the implementation class receives a percentage of 60%. The third indicator of verbal representation is defining the concept in the modelling class obtaining a percentage of 69.64% and the implementation class obtaining a percentage of 77.50%. Then, the fourth indicator of verbal representation ability, which explains the results of the graph in the form of verbal representation in the modelling class, is obtained by the percentage of 63.39% and the implementation class 62.50%.

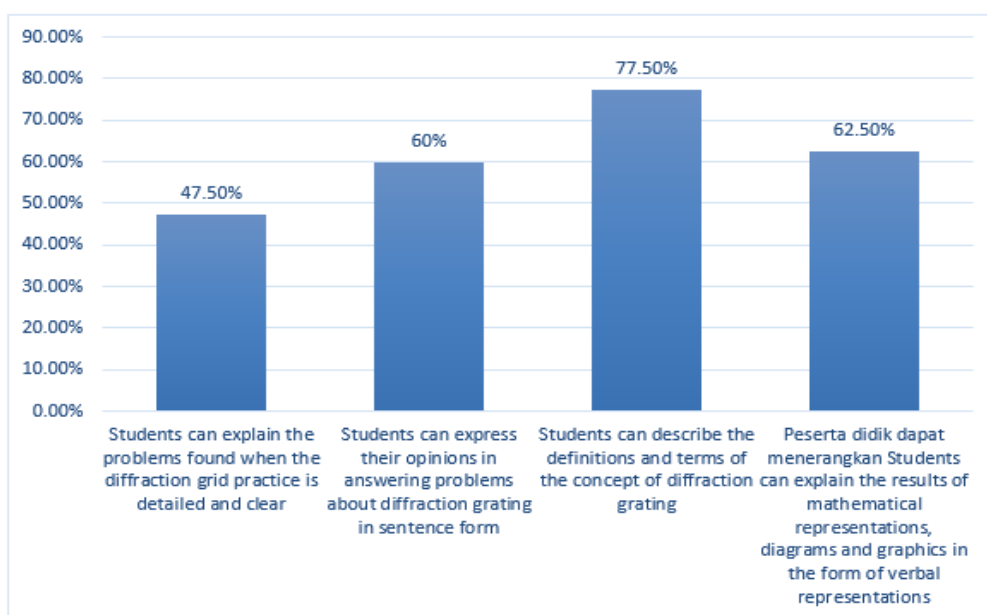


Figure 2. Verbal representation assessment chart for implementation class

Multimedia learning modules are introductory media that aim to encourage students' motivation to actively participate and be able to prepare and have initial knowledge before learning activities begin [7-8] [27]. Learning resources or media in the form of human or non-human (hardware and software), availability is very influential on the learning process. Some research results state that the availability of learning resources is very influential on the learning outcomes of students. The application of the learning strategies or methods related to each learning strategy is used both in particular learning materials or content, and also in certain media or learning resources needed. Media development must be truly in accordance with what is needed so needs analysis needs [28].

A study on the impact of using multimedia with simulation methods showing students who use better performance in answering conceptual questions [29]. Gokhale's study in 1996 showed that computer simulations can help students' motivation and develop review skills [30]. This statement is in accordance with the results obtained by the researcher in training one of the representation abilities of students, namely verbal representation. These results indicate that application of multimedia learning modules assisted by tracker virlab application can be used to train verbal representation skills.

5. Conclusion

The selection and use of multimedia as a medium is not only based on the implementation of laboratory activities that experience obstacles such as expensive equipment, require a long time or require experienced physics teachers, but based on the use of multimedia can improve the quality of teaching and learning activities. Multimedia learning modules are an introductory medium that aims to encourage students' motivation to actively participate and be able to prepare and have initial knowledge before learning activities begin. The results of the analysis and discussion can be concluded that learning activities by applying of multimedia learning modules assisted by tracker virlab application can be used to train verbal representation skills.

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