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The Development of Learning Devices with the Etnoid (Ethnoscience Android) Assisted Guided Inquiry Model on Vibration and Wave Materials

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***Abstract*— This research was conducted in two stages; the preparation stage which was aimed to develop the device, followed by the implementation stage of learning in the classroom using the pretest-posttest design. The validation test consisted of media validation tests by media expert lecturers from the chemistry department and one junior high school science teacher, and the material validation test by material experts from the Science Study Program lecturers. The learning phase was carried out by involving 30 eighth grade students at Junior High School who had taken the material of vibration and waves. The results of the development were in the form of learning tools with Etnoid-assisted guided inquiry model. The validity score was 93.88%, indicating the very valid category, practicality score was 86.70%, of very practical categories, while effectiveness was 0.703, of high category, meaning that information was very effective to use in learning. Based on results, it could be generally concluded that the learning device developed with Etnoid-assisted guided inquiry model met very decent criteria.**

Keywords*— *Guided Inquiry, Ethnoscience, Vibration, Waves

I. INTRODUCTION

Science essentially includes three main elements; attitudes, processes and products [1,2]. It is stated that attitudes are a curiosity of objects, natural phenomena, living things, and causal relationships (causality) which caused new problems and can be solved through the right procedures. The process is problem-solving procedures through scientific procedures.

Data showed that the majority of students have difficulty in understanding the concept of science as a whole. Based on the questionnaire given by the researcher to one of the eighth grade students, it was shown that as many as 56.2% of students had difficulty in learning science, especially to learn the material for vibration and waves. Another problem that arose during the implementation of science learning in junior high school was the students' low scientific work. This was because, at the time of learning, the teacher more often performed learning in the classroom than in the laboratory, in other words, students only accepted the concept of "just" [3]. This condition causes students to be less trained to find out for themselves the facts and concepts from learning the material and apply concepts learned in real life. Students who are not trained to find their own facts and concepts in the learning process cause them to be less trained to think at a high level. The problems in science learning can be overcome by using inquiry learning models. Inquiry learning at the junior secondary level is still at the level of guided inquiry [4]. Guided inquiry learning places students as learning centres and teachers as facilitators who guide students to develop their understanding [5]. Therefore, this study used guided inquiry to induce students were more active in learning with guidance and direction from the teacher.

Besides learning with a guided inquiry, learning could also use the potential of the local environment. Previous research showed that place-based inquiry could improve student achievement and encourage critical thinking skills [6]. Inquiry learning utilizing environment can make students learn about many things directly related to everyday phenomena. Thus, students can develop knowledge, skills, attitudes to participate in their lives [7]. The science learning approach with ethnics in making tempeh showed an increase in student learning outcomes [8], while study using ethnics learning showed that this learning helped students to think critically [3]. Previous research showed that there was an increase in learning outcomes using media science stories based on ethnoscience [9]. Based on this description, it was necessary to study "The Development of Learning Devices with the Etnoid (Ethnoscience Android) Assisted Guided Inquiry Model on Vibration and Wave Materials".

II. REVIEW OF RELATED LITERATURE

A. *Etnoid Learning Media*

In science learning, we need a learning media to help students visualize abstract material. Sound material consists of material on vibration and wave presenting the invisible phenomenon [10]. To convey invisible material or concept, media is necessary. In the 2013 curriculum, one of the

invisible or abstract concepts is the wave propagation process taught in eighth-grade students of Junior High School.

One of the efforts to overcome the problems in the learning of wave propagation process is by creating a media to visualize the abstract process. Picture media often used in books cannot explain this process clearly. One of the media that can visualize clearly the concept is video. Videos are quite effective in teaching applicable and processable materials that difficult to be delivered [11]. To include the videos in the learning process, personally recorded videos of each gamelan instruments were included in PowerPoint and converted to APK using the WTPTT application on the computer.

Sound material using Android-based Ethnosains or called Etnoid could be applied during the learning process in the classroom or used independently outside the classroom. The use of instructional media in the classroom served as an alternative source of learning or complements of material in the learning. The use of media outside the classroom can be conducted independently by students anywhere and anytime with the aim of ease students in learning without having to open textbooks. Ethnoscience itself is the use of life phenomena as examples in a certain matter. Besides being able to understand better materials of vibrations and waves, students could also have a better understanding of arts and culture, in addition, to train students' abilities in practising higher-order thinking.

B. *Guided-Inquiry Model*

Inquiry in science learning is a learning method which includes the process of exploring nature, answering questions, making investigation, and careful testing in the search for new knowledge [12]. The Guided-Inquiry Model is a learning method which involves students in finding knowledge or understanding to investigate, starting from making observations, asking questions, planning investigations, collecting data or information and conducting investigations, analyzing data, making conclusions and communicating the results of investigations.

Inquiry learning places students as learning subjects. Students play a role to find their own core of the subject matter itself. Teachers play the role of guiding and acting to bring change, facilitator, and motivator for their students [13]. Several characteristics of inquiry learning [13] are:

- Emphasize the maximum activities of students to search and find, place students as subjects of learning. Students not only act as recipients of the lesson through a teacher's explanation but also play a role to discover the core of the subject for themselves.
- All the activities carried out by students are directed to look for their own answers to something previously questioned, thus it is expected to foster an attitude of confidence, thereby placing teachers as facilitator and motivator of student learning.
- The purpose of inquiry learning is to develop the ability to think systematically, logically, critically, or develop intellectual abilities as part of mental processes. Thus, students are not only required to master the material, but also how they can use their potential.

III. METHODS

Development of learning device model in the current study adapted from *Four-D model* or 4D model. This model has four stages; define (limitation), design (design), develop (development), and disseminate (spread) [14]. This model was used because the 4D model was arranged in a systematic sequence of activities and the suitable for the development of learning devices. The development stages of the learning device were modified and adapted to the needs arose.

The product feasibility test in this study was conducted through three stages, namely validity test, limited trial. Validity test is aimed to assess the feasibility of the media, while the limited trial is aimed to assess the feasibility of media learning devices for audiences or users. The subjects involved invalidity test consisted of 2 validators; a media-expert validator and a material-expert validator. Validator of media expert was a lecturer at Universitas Negeri Surabaya study program competent in their respective fields. The media expert validator was lecturer from chemistry department in Universitas Negeri Surabaya. Practical Tests were conducted by education practitioners, who were science teachers with a minimum of 5 years of teaching experience and respondent student. The trial subjects in the limited test of effectiveness test were thirty-eighth-grade students Junior High School. The effectiveness test was carried out by performing pretest before the media was applied in the learning process, then posttest at the end of the learning process to determine students' final grades in learning.

Tests on improving student behaviour after learning process using Etnoid, assisted learning devices, was done using gain score [15]. The standard criteria of the gain score can be categorized into three, as presented in Table 1.

TABLE 1. THE STANDARDIZED CRITERIA OF GAIN SCORE

Result of gain score	Criteria
Gain > 0.7	High
0,7 >gain>0,3	Medium
Gain < 0.3	Low

IV. RESULTS

This study produced guided inquiry learning devices assisted by Etnoid on vibration and wave materials (syllabus, learning plan, worksheet, question instruments, learning media) validated by the material and media experts. The validity values of the experts on Etnoid assisted learning devices showed an average score of 3.76 with a percentage of 93.88%. Thus, devices were declared very valid. The development of learning devices was adapted to conditions of Junior High School students. Based on the analysis of the students at Junior High School, most students had an android device which could be utilized during the learning process.

The practicality value of a learning device could be determined based on the ease of use in the process of learning activities, so that validation was carried out by learning practitioner; the science subject teacher in the school. The teacher knew in more detail on the conditions of learning in the classroom. The results of validation by learning

practitioners showed an average score of 3.47 with a percentage of 86.70%. So, it could be said to be very practical. The results of the practicality validation were also strengthened by the implementation of good learning using learning tools. The purpose of developing this device with Etnoid-assisted guided inquiry model was to be able to improve high-level thinking skills of students.

The results of the implementation of the developed product on high-level thinking skills are presented in Table 2, while the score difference of pretest and posttest in Figure 1. There was a score increased with a gain of 0.703, indicated the high category. This showed that the guided inquiry learning model assisted by Etnoid was very effective to improve high-level thinking skills of students.

TABLE 2. THE SCORE OF PRETEST AND POSTTEST

Class	Value		
	Average score of pretest	Average score of posttest	Maximum Score
8G	12,1	73,9	100
$Gain = \frac{\text{Average score of posttest} - \text{Average score of pretest}}{\text{Maximum score} - \text{average score of pretest}}$			
$= \frac{73{,}9-12{,}08}{100-12{,}08}$ = **0,703**			

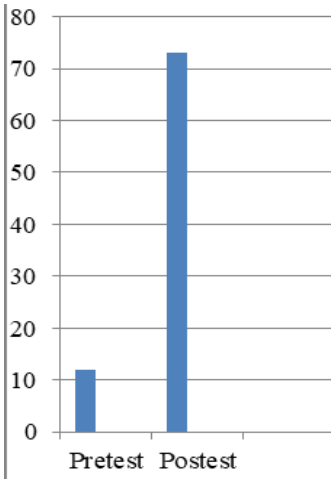

Figure 1. The mean score of pretest and posttest

V. CONCLUSION

The learning devices developed using assisted guided inquiry using Etnoid model was found to be very feasible to be implemented in science learning of vibration, waves and sounds materials with validity value of 93.88% (very valid category), practicality of 86.70% (very practical category), and effectiveness of 0.703 (information was very effective) in learning.

The results of the implementation of learning devices with the Etnoid assisted guided inquiry model showed that learning devices were able to improve high-level thinking skills of students, but they were still needed to be adjusted to certain situation and conditions at school.

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