



THE DEVELOPMENT OF M-DIAGNOSTIC TEST TO IDENTIFY THE UNDERSTANDING LEVEL OF JUNIOR HIGH SCHOOL STUDENTS IN TEMPERATURE SUBJECT

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Article Info

Received December 2016
Accepted January 2017
Published February 2017

Keywords:
M-diagnostic test; concept understanding; temperature.

Abstract

The purpose of this research was develop a mobile phone diagnostic test product which use to identify student's concept understanding in the temperature and heat material. This result indicated the level of student's concept understanding in the temperature and heat material. This research has three steps for trial product. The steps were limited-scale, wide-scale, and implementation. The validation result by professional of instrument test, professional of media, and the questionnaire responses of students has been showed that the m-diagnostic test worthy to used because the product has fulfilled contents aspect, language aspect, construct aspect, software technology aspect, and visual communication aspect. The result of diagnostic test in implementation step are showed 6 students from 18 students that achieves a minimum completeness criteria. The result of student's concept understanding that included in the relational understanding criteria for each indicator was 50% relational understanding for indicator 1 (knowing the definition of temperature and heat), 55% *relational understanding* for indicator 2 (understand the scale of the temperature on the thermometer. The results from this research indicated that the m-diagnostic test worthy to use for diagnose the level of student's concept understanding.

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p-ISSN 2252-6617
e-ISSN 2502-6232

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INTRODUCTION

Physics is one of Natural Science subjects which is aimed to analyze and discover quantitative understanding of natural process and the nature of certain substance with its application (Sirait, 2008). According to Rusilowati (2006), physics is prerequisite, meaning that the new concept of subjects insisting on previous concept understanding. Thus, the difficulty of learning experienced by the students will be carried to the next level of education. The success of the learning process is the main thing coveted in the implementation of education in schools. Teachers and students in the learning process are the main components. Teachers should be able to guide students in such a way that they can develop their knowledge according to the knowledge structure of the studied field. To achieve this success the teacher must fully understand the material being taught, in addition, the teacher is also required to know exactly where the position of knowledge of students at the beginning of following certain material. Furthermore, based on the method chosen teachers are expected to help students in developing their knowledge effectively (Setyawardani et al, 2012).

Educators must develop a formative and a summative assessment. It is necessary to collect information and see what the students have done. This assessment activities help the students to develop learning process, and also the student needs to measure the achievement of has learned in its entirety (Wusqo et al., 2015). But, different teachers will find different aspects of classroom formative assessment more effective for their personal styles, their students, and the contexts in which they work—so each teacher must decide how to adapt the ideas outlined above for use in their practice. Of course, as always, “more research is needed,” but the breadth of the available research suggests that if teachers develop their practice focused on the principles outlined above, they are unlikely to fail because of the neglect of subtle or delicate features. There will never be an optimal model, but as long as teachers continue to investigate that extraordinarily complex relationship between “What did I do as a teacher?” and “What did my students learn?” good things are likely to happen (William, 2013)

Diagnostic test is a test used to determine the weaknesses of students so that based on weakness weakness it can be done placement (placement) is right. The specificity of diagnostic tests over other tests is that diagnostic tests can be used to overcome

learning difficulties (Wijaya et al., 2013). Generally, current popular tests or diagnostic tests in manual forms are not practical. The tests need more time to correct. Besides, the result of the test usually make the educators do not directly understand the students level of understanding in certain materials. Thus, more innovative alternative diagnostic tests media are highly needed.

The development of knowledge and technology encourage the attempts of utilizing the technology in learning process. Technology becomes the highly-required necessity of people (Hernawati, 2012). Diagnostic tests using mysql-based php-based computer programming has successfully created by Saidah & Rinaningsih (2012). Its use is still limited to use the computer, therefore will be attempted making diagnostic test based on android/smartphone.

Currently, the development of smartphones have developed very rapidly. Device technology software has added a variety of useful software functions. The software can serve as one form of learning media that is moveable. (Alfian & Kustijono, 2015). Most of Indonesians use smartphone in every aspect of life. Pereira & Rodrigues (2013) stated that the mobility should offer the ability to guide and support students and teachers in new learning situations when and where it is necessary. The dependency of the content can be relative to location context (i.e. the system knows the location where the learner resides and adjusts to it), temporal context (i.e. the system is aware of time dependent data), behavioral context (i.e. the system monitors the activities performed by the learner and answers to them adjusting its behavior), and specific interest context (i.e. the system modifies its behavior according to the users preferences).

The development of learning through mobile devices can improve the effectiveness and efficiency of students' learning. The use of Android-based learning media is one application of the 21st century learning style (Calimag et al., 2014). The use of this kind of learning media has the potential to help improve the academic performance of learners in the form of learning outcomes in the cognitive domain (Chuang & Chen, 2007; Jabbour, 2014). According to Georgiev et al. (2004), the use of mobile device in the learning process was then famously known as mobile learning (m-learning). The

existence of m-learning is aimed to become the complementary device for learning process providing students time to review the materials everywhere and everytime. This thing gives the students experiences for the students learning process. The process of online diagnostic tests needs mobile devices of Android OS to be connected to the internet. According to that explanation, the researcher tried to answer the research of "The Development of M-Diagnostic Test to Identify the Understanding Level of Junior High School Students in Temperature Subject".

METHODS

The research was done in April-May 2016 in SMP Negeri 3 Batang in the even semester. The research method was developed based on research and development approach adapted from Sugiyono (2009). The potential result identification and the problems in the school should be used to design m-diagnostic test. The validation process of this research involved two experts, the experts of media and test instrument in each consist of three validators. The validity determined the fit and proper test of m-diagnostic test to be used in the research. Limited scale trial test involved 10 students from VII D class after the m-diagnostic test considered as proper by the experts. In limited scale trial test, the students give opinions which are used as the evaluation material before going to the wider range (14 students of VII D class). This thing will be continued to the implementation step (18 students of VII C class), thus, the result of m-diagnostic test will be more proper to be used.

RESULTS AND DISCUSSION

The results of this research include the fit and proper test of m-diagnostic test by the experts, respondents, and students understanding for temperature materials.

The reliability of *m-diagnostic test*

The fit and proper test criteria of m-diagnostic test are guided based on the proper test of the Senior High School Textbook published by BSNP modified by Wahono (2006). The scoring aspects are, including the properness of the contents, the construction, language, software manipulation, and visual communication. The result of fit and proper test to m-diagnostic by the experts of test instruments are served in Table 1 and Table 2.

Table 1. Fit and Proper Test of m-diagnostic test done by Experts of Test Instruments in the first validation step

Validators	% Scores of Properness	
	Contents 1,2,3,7	Construction 4,5,6,8
Validator 1	100	93.75
Validator 2	93.75	93.75
Validator 3	93.75	87.5
Average	95.83	91.67
Criteria	Very Proper	Very Proper

Table 2. Fit and Proper Test of m-diagnostic test done by Experts of Test Instruments in the second validation step

Validators	% Score of Properness	
	Contents 1,2,3,7	Construction 4,5,6,8
Validator 1	100	100
Validator 2	100	100
Validator 3	100	93.75
Average	100	97.92
Criteria	Very Proper	Very Proper

The result of fit and proper test to m-diagnostic by the experts of learning media are served in Tabel 3 dan Tabel 4.

Table 3. Fit and Proper Test of m-diagnostic test done by Experts of Media in the first validation step

Validators	% Score of Properness		
	A	B	C
Validator 1	93.75	91.67	100
Validator 2	87.5	91.67	100
Validator 3	87.5	91.67	100
Average	89.58	91.67	100
Criteria	VP	VP	VP

Note:

A = Contents

B = Construction

C = Others

VP = Very Proper

P = Proper

Table 4. Fit and Proper Test of m-diagnostic test done by Experts of Media in the first validation step

Validators	% Score of Properness		
	A	B	C
Validator 1	100	100	100
Validator 2	93.75	100	100
Validator 3	100	100	100
Average	89.58	91.67	100
Criteria	VP	VP	VP

Note:

- A = Contents
- B = Construction
- C = Others
- VP = Very Proper
- P = Proper

Concept Understanding

The understanding of temperature subject by the students in this research was known from the students' answers and reasons in m-diagnostic test. According to Rusilowati (2006), the difficulty of learning can be analyzed from the patterns of the wrong answers from the students and the deeper analysis to the structure of answers given by the students. The multiple choice exercise from the Physics diagnostic test, the determination of wrong option of answers have been arranged to describe the students' mistakes. The mistakes can be seen from the understanding of concept and the ability of the students to convert certain unit.

Table 5 shows the scoring criteria from the diagnostic test with concept understanding level which has been made by Skemp as quoted by Yoanita (2014)

Table 5. Scoring Criteria *M-Diagnostic Test*

Condition	Types of Responses	Score
<i>Misunderstanding</i>	Wrong answers and reasons	0
<i>Instrumental Understanding</i>	Correct Answer and Wrong Reason	1
	Wrong Answer and Correct Reason	1
<i>Relational Understanding</i>	Correct Answers and Reasons	2

Profile of Indicator 1

Indicator 1 consists of 2 types of test items. Exercise number 5 is related to the types of thermometer, Exercise number 7 is related to the best liquid substance can fill the thermometer best. The complete data for indicator 1, regarding the definition of temperature and thermometer is shown in Figure 1.

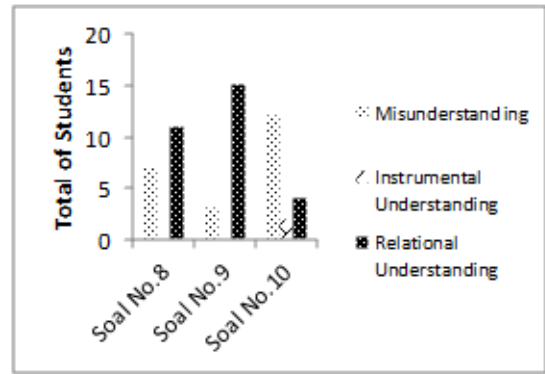


Figure 1. Profil of Understanding to Indicator 1

Based on the result of the research presented in Figure 1, the average number of students which answered the exercise correctly in this indicator were 50%, therefore, it can be interpreted that only 50% students who understand the concept since they can explain the definition of temperature and thermometer correctly. Meanwhile, the other 50% students have difficulties in defining those terms from their wrong answer, or wrong answer and reason.

The mistakes regarding the concept understanding of the students are detected in the indicator of understanding the scale of thermometer, including : (1) the students were not able to identify the types of thermometers based on their functions, and (2) the students were not mastering the material regarding the strength and weakness of liquid substance in thermometer.

Profile of Indicator 2

Indicator 2 consists of 3 types of test items. Exercise number 8 is related to the unit of temperature from the International Standard, exercise number 7 is related to the comparison of temperature in Reamur to Fahrenheit. Exercise number 10 is related to the reading of temperature in the degree of Fahrenheit and Celcius. The data is shown in Figure 2.

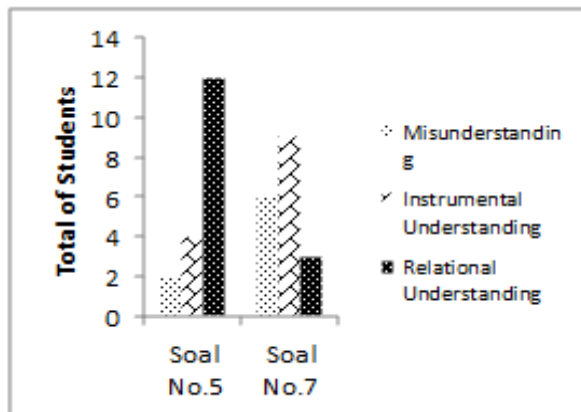


Figure 2. Profile of Understanding to Indicator 2

Based on the research result which is presented in Figure 2, the average percentage of this indicator was 55.55%, while the answers which can be interpreted correctly were only 55.55%. Nonetheless, the rest 44.45% students were still unable to understand the concept indicated from their wrong answers, or the wrong choices of answers and reasons. As stated by Duskri et al., (2014) Student-level diagnostics individually illustrate the strengths and weaknesses of each individual student. While group diagnosis describes the strengths and weaknesses of students based on specific points based on reports of scores of the test scores. the program is considered effective in diagnosing students 'learning difficulties' because there is a significant difference between students' test results from high ability and low ability.

The forms of mistakes of concept understanding detected to the indicator of understanding the scale of thermometer, including: (1) the students were unable to know the unit of temperature in International Standard, (2) the students were unable to master the mathematical equation, (3) the students were unable to memorize the required formulas for temperature, (4) the students were weak in measuring temperature (the steps of doing the exercise were incorrect).

The researcher suggests that the future researcher with similar background should take different theme in developing the alternative evaluation tools in learning process using mobile devices of Android with screen resolution of 320x480 pixel (3.2 inch) API series: Android 4.0.3 (*Ice Cream Sandwich*) with stable connection. There should be a development in managing the students answers in m-diagnostic test to anticipate special condition, like: mobile hang or sudden switched off

that it will help the students doing their exercise efficiently.

CONCLUSION

Based on the analysis of m-diagnostic test in temperature and heat for students of VII grade in junior high school, the tests was considered proper to be used as the diagnostic tests since it has fulfilled the aspects of properness from contents, construction, language, software, and visual communication based on the standard of BSNP modified by Wahono (2006). The results of test validity in step 1 and 2 obtain the average score of 94.13 %. The result of media validity in step 1 and 2 has fulfilled the minimum properness with the average score of 94.52% with very good criteria.

The profile of concept understanding to the students in temperature section is: (1) indicators 1 were related to the definition of temperature and thermometer with the percentage of relational understanding in 50%, instrumental understanding in 36%, and misunderstanding in 14%. (2) Indicators 2 regarding the understanding of temperature scale were scored in percentage with the details of relational understanding in 55%, instrumental understanding in 4%, and misunderstanding in 41%.

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