

Research Article

Development of Structured Essay Questions to Measure the Student Higher-order Thinking Skills at Senior High School 2 Purworejo

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Abstract.

Students were expected to not only have lower thinking skills but also higher thinking skills too. We need a measuring instrument to understand the student's higher-order thinking skills. One way of analyzing is through structured essay questions. This could help us show the students higher-order thinking skills and help them in solving the questions to the problems systematically. This research used the research and development method which produced structured essay questions. This study aimed to understand the character of structured essay questions that can validate the students higher-order thinking skills. And, to determine the level of effectiveness of structured essay questions for measuring students thinking skills on sound wave materials. This research was held in SMA Negeri 2 Purworejo. The feasibility test was done by giving a product feasibility questionnaire to experts and students. The product effectiveness test was done by calculating the correlation between student daily test scores on sound wave materials by using non-structured essay questions and student test scores using structured essay questions. The result of the feasibility structured essay test based on expert opinion was 87.65%; therefore, the product category was worthy. The result of the effectiveness test showed the correlation coefficient of student daily test scores using non-structured essay question with daily test scores using structured essay questions was 88.9% and included in very good criteria. So, it can be concluded that structured essay questions on sound wave materials are valid and effective to measure the students higher-order thinking skills.

Keywords: structured essay question, high-order thinking skills

1. INTRODUCTION

Based on the national education system law at number 20 in 2003, the Indonesian government declared science as one of knowledge that had been held in elementary school [1]. Although science had existed in elementary school, there are limit questions that can train the student higher thinking skills. Because of that, need the instrument

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development to train the student higher thinking skills [2]. Beside, the student higher thinking skills can be trained by teaching inquiry with cognitive conflict strategies [3] or teaching with problem based learning models [4].

Istiyono said that students in a school determined not only have low order thinking skills but high order thinking skills too [5]. The students that have higher thinking skills could understand something with essay way and have a big opportunity to be a good problem solver. Based on the reasons above, a higher thinking skills was very needed to learn something. So, a teacher should have known the level of student higher order thinking skills. Students higher order thinking skills could be measured with many instruments, one of them is essay questions [6]. One of essay questions that can measure the student higher thinking skills is structured essay questions.

A research used structured essay question to measure the student higher order thinking skills. The result of this research was a student with high order thinking skills would get a good point in their examination test and students with low order thinking skills would get a bad point in their examination test. This result shows us that structured essay question could measure the student higher order thinking skills. Beside, the structured essay question offers easier in answering the question than the common easy question [7] and leads to a specific answer [8].

Mabrurroh in 2016 declared that the instrument that can be guidelines to measure the student higher order thinking skills in sound wave materials is least, so we need a development about that [9]. Based on the fact, the development of structured essay-questions was done in sound wave materials with an assumption that these questions can measure the student higher order thinking skills correctly.

Based on the research that had done by Suhandi since 2015 until 2018, students in senior high school 2 Purworejo have a good behavior [10]. They have a high discipline, obey with the rules in the school, have a high responsibility, and have an enthusiastic feel with the homework from their teachers.

2. RESEARCH METHOD

The kind of this research was research and development method. Based on the research that had done before, we get a result that structured essay questions in wave materials were difficult to find, need a further research about that. With the research that had done, we will have an accurate measurement to know the level of student higher thinking skills. The validity and effectivity of the measurement that used in this research could

be shown with the student answer in each question number. The successful of this research would be grown too much of research with the same topic.

The result of feasibility test of structured essay questions to measure the student higher order thinking skills was done by two lecturers and one teacher of senior high school. Test were done in two steps. The first step was done in February 2020, and the second step was done in July 2020. Next, if the structured essay questions had gotten the score and be repaired, the questions can be given to students in two steps. The first step was done by 25 students in XI MIPA 1, and the second step was done by 100 students that composed by XI MIPA 2, XI MIPA 3, XI MIPA 4, and XI MIPA 5. On the other hand, XI MIPA 1 in this research was small testing class, and the other students from XI MIPA 2, XI MIPA 3, XI MIPA 4, and XI MIPA 5 in this research were field testing classes.

The first testing in this research was done in May 2020, and the second in July 2020. Each of them was done by online method with google classroom application in a week. The location of this research was in senior high school 2 Purworejo. The online method was done because all of the students could not be met in direct learning in a class. This phenomenon was caused by corona virus that attached Indonesia and other country.

Subject of this research were MIPA students in senior high school 2 Purworejo that had gotten all of the material about sound wave materials in physics learning by their teacher. The class that used in this research is class of XI MIPA 1 with their code is UK 1-25. The world UK in this research was gotten by the sentence "small group test". The other classes that used in this research were class of XI MIPA 2, XI MIPA 3, XI MIPA 4, and XI MIPA 5 with their code is UB 1-100. The world UB in this research was gotten by the sentence "field test".

The name of students in this research was arranged with random method to keep the secret data of them. This research was done with formative type of research that had been found by Tessmer in 1993 with some modification was done by Zulkardi in 2006 [11, 12]. The illustration of the research can be seen in Figure 1.

This research used three data retrieval method. They were documentation, student questionnaire, and test. Documentation method was done with asking the daily student score test in sound wave materials, their complete name, and their schedule. Students questionnaire was done with gave each student 15 questions response about structured essay questions that had done before. Test method was done to measure the student higher order thinking skills with gave them 10 structured essay questions in sound wave materials.

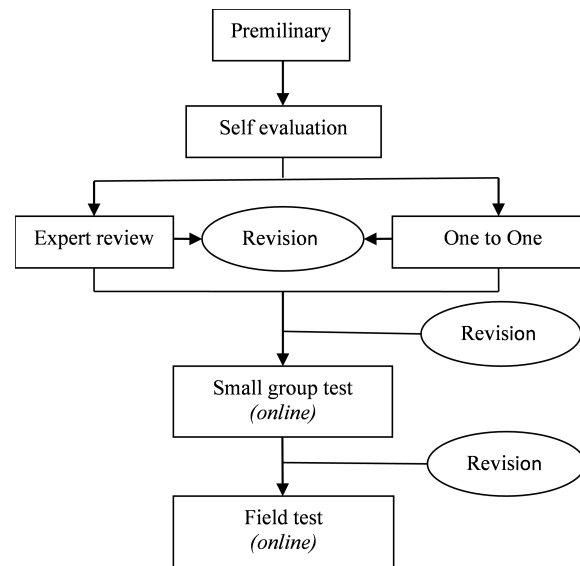


Figure 1: Formative research design.

The test quality that used in this research were validity, reliability, difference test, and difficulty test range of structured essay questions to measure the student higher thinking skills. Apart of them, the feasibility score from expert person was use too. The feasibility score was needed to improve the quality of the structured essay question especially in the content, construct, and the laguage of the test. The feasibility of structured essay questions from this research can be seen with the correlation of student daily score test and student structures essay test. Before that, all of the data must be in normal distribution first.

3. RESULT AND DISCUSSION

Based on the research that had done in Mey-July 2020, the result of the test was structred essay question in wave materials was feasible to measure the student higher thinking skills with the score of the feasibilty test was 87.65%. This good score was gotten because the structured essay question had repaired in many times. The test repaired was held in laguage of the structured essay question, the content of the test, and the correlation of each part of the test. In general, the result of the feasibility test of structured essay question can be seen in Table 1.

Student response of this research was positive. Most of the students agreed if the problem that served in the test can found in daily activity. Students said that the structured essay questions have a good symbol and picture. The structured essay questions also had a clear formula, so the students could understand what the main

TABLE 1: The result of feasibility test of structured essay question.

No	Aspect	Content		Construct		Language	
		Score	%	Score	%	Score	%
1	Validator 1	8	88.89	9	100	7	77.78
2	Validator 2	6	66.67	8	88.89	8	88.89
3	Validator 3	9	100	7	77.78	9	100
Mean		7.67	85.19	8	88.89	8	88.89
Criteria		very worthy		very worthy		very worthy	

problem of the question. Students said that the structured essay questions had helped them to think about something systematically. The result of the student response in this research can be seen in Table 2.

TABLE 2: The students score of the structured essay questions.

Responden	% Aspect				
	Language	View	Systematics	Function	Testimony
Small group test	84.67	77.5	69.50	76.0	77.0
Field test	76.67	83.5	78.18	78.2	76.8
Mean	80.67	80.5	73.84	77.1	76.9
Criteria	good	good	good	good	Good

The quality analysis in each question in this research was done with processing the student answers to know about validity, reliability, different level of question, and difficult level of question. Based on the research, the structured essay question was a valid instrument to measure the student higher order thinking skill because the r counting score was more than the r table in each question. The reliability score of structured essay question in this research proved that 10 questions in this research was feasible to measure the student skill. The validity and reliability level of question in this research proved that the structured essay question that had given to student was correct to measure the student’s higher order thinking skills.

The another quality analysis in this research was different level question of structured-essay question. The different level question of this research shown us that there are 5 questions have a good level to measure the student higher order thinking skills, and the other had a moderate level to measure the student skills. The difficult level question in this research shown that there were 8 structured essay questions that need improvement. Two other questions, had a good difficult level question. It was mean

that they could show the student with low order thinking skill and the student with high order thinking skill correctly.

The student higher order thinking skills profile in this research are about analyze, evaluate, and create something from the problems of the question. Based on the research that had done before, the result of student analyze skill was good with score 69.6%. The student’s skills in evaluation the problem that served in the question was good with score 72.74%. The student’s skill in create a way to solve the problem that served in the question was good with score 68.68%. Based on the result of student skills in analyze, evaluate, and create something, we can conclude that the students of senior high school 2 Purworejo have a good higher order thinking skills with score 70.34%. The result of students’ higher order thinking skills in analyze, evaluate, and create something can be seen in Table 3.

TABLE 3: The student’s higher order thinking skills.

Aspect	Small group test	Field test
Analyzed	66.4	69.6
Evaluated	74.4	72.74
Created	63.6	68.68
Means	68.1	70.34

The effectiveness of structured essay test to measure the student higher order thinking skills in this research can be known by look at how the correlations that had created between daily examination in sound wave materials and structured essay questions. Before do the correlation test, we should know that all of the data were in normal distribution. Based on the research that had done, the result of the correlation test between daily examination test and structured essay question was 88.3% and it can be concluded that the category was very strong correlation. The result of normality test and correlation test in this research can be seen in Table 4.

TABLE 4: The result of normality correlation test.

Value	Daily Examination		Stuctured Essay	
	Small	Field	Small	Field
Normality test	8.70%	6.10%	35.20%	39.40%
Correlation test	93.30%	88.30%	93.30%	88.30%

The strong correlation between daily test in sound wave materials and structured essay questions shown that students with good value in daily examination would get a good value in structured essay question too. Students with bad value in daily examination in sound wave materials would get bad value in structured-essay question too. This

result shown that the two types of question was in line. So, the structured-essay question was effective to measure the student higher order thinking skills. The correlation graphic between student daily examination test and structured essay question to measure the student higher order thinking skills can be seen in Figure ??.

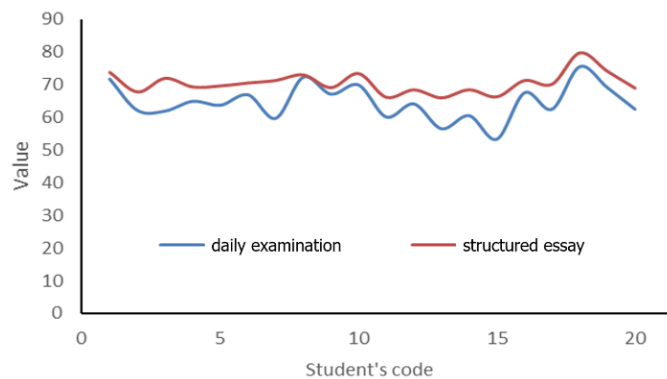


Figure 2: Percentage for each scientific process skills question.

4. CONCLUSION

Based on the research that had done, we can conclude that : 1) essay structured question was a valid test to measure the student higher order thinking skills, with the character of the test were systematic and had a correlation all of the part each other, 2) the structured essay question that had developed was an effective test to measure the student higher order thinking skills because have a strong correlation with daily examination test in sound wave materials.

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