VALIDITY OF THE QUESTIONS PACKAGE TO MEASURE STUDENTS' HOTS IN PHYSICS LEARNING IN HIGH SCHOOL

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ABSTRACT

This study aims to determine the validity of developing the question package to measure students' High-Order Thinking Skills (HOTS). This study was conducted because the usual questions have given by the teacher do not yet contain indicators of HOTS. By HOTS, students can have reasoning skills in inductive and deductive thinking. This skills can be applied to explain various physics concepts and solve problems qualitatively and quantitatively in the new situations. The type of this study is Research and Development (R&D) by adopting the 4D development, including: Define, Design, Develop, and Dissemination. The instrument of study used validation sheets to test logical and empirical validation. The subjects of this study were students of class XII Science in SMAN 2 Jember, SMA Nuris Jember, and MAN 1 Jember. Based on the results of the logical and empirical validation tests stated that the package of physics questions have been developed in the valid criteria. It can be concluded that the question package could be used to measure students HOTS.

Keywords: *Physics questions package; HOTS; Validity of the questions package*

1. INTRODUCTION

Physics are one of the lessons to forming students to have reasoning skills in thinking inductive and deductive analysis. This skills can be applied using physics concepts to explain various concepts of natural events and be able to solve problems qualitatively and quantitatively (BNSP, 2006). This is also reinforced by the suggestion of the government that the assessment is not planned to measure knowledge and concepts, science process skills and high-level reasoning. Thus in the application of physics learning, students are also required to have High-Order Thinking Skills (HOTS).

HOTS according to Heong, et. al (in Rofiah, et.al: 2013) is described as an activity in using the mind more broadly to find new challenges, besides that require someone to apply new information to knowledge before and manipulate information to reach possible answers in new situations. HOTS is a skill that is not just memorizing facts or conveying something to someone exactly to what is desired to us, but rather a thought process that involves mental activities in an effort to explore complex, reflective and creative experiences that carried out consciously (Wardana: 2012). It can be concluded that, HOTS is a thinking process that not only memorizes or relinquishes the information obtained but rather the ability to connect, manipulate, and transform the knowledge and experience that is already possessed to think critically and creatively in determining decisions and solving problems.

Monitoring processes, progress, and improving student learning outcomes sustainably requires an assessment (Wahyuningsih, et.al, 2013). Based on Minister of National Education Regulation No. 20 of 2007 the assessment of education is a process of gathering and processing information to determine the achievement of student learning outcomes. Assessment can be done orally or in writing. In this case a written assessment is carried out by holding a

written test. According to Istiyono, et. al., (2014) there are two forms of written tests, namely choosing answers and supplying answers. Written test questions whose answers use the choice of answers include: multiple choice, two choices (right-wrong-no, matchmaking and causation).

Instrument of assessment in the form of written tests besides be used to determine the profile of students' skills, can also be used to train students' HOTS (Rofiah, et.al, 2013). The use of questions in practice can be formed problems that test students in solving problems, critically and creatively thinking. From the questions provided by students, it requires high-level reasoning skills or high logical thinking. High-level and logical thinking is needed by students in the learning process in the classroom, especially in answering questions because in this process students need to use knowledge, understanding and skills to connect in new situations.

This study aims to determine the validity of developing questions package to measure the students' HOTS. The background of this study caused by the usual questions have given by the teacher do not yet contain indicators of HOTS. By HOTS, students can have reasoning skills in inductive and deductive thinking. This skills can be applied to explain various physics concepts and solve problems qualitatively and quantitatively in the new situations.

2. METHODOLOGY

The type of this study is Research and Development (R&D) by adopting the 4D development, including: Define, Design, Develop, and Dissemination (Thiagarajan, et. al., 1974). R&D are the type of study that used to develop certain products and to test the effectiveness of these products. The results can be new products or improvements to existing products. This development model refers to a descriptive procedural model. The instrument of study used validation sheets to test logical and empirical validation. This instrument is used to determine whether a test has validity or accuracy in measuring the students' HOTS. The subjects of this study were students of class XII Science in SMAN 2 Jember, SMA Nuris Jember, and MAN 1 Jember

Data collection techniques used in this study use data sheet validity obtained from the validator. Data analysis techniques used in this study are:

a. Validity analysis by experts
Validity is done by science education expert judgment, which consists of lecturers of Science Education in University of Jember and a teacher of High School in Jember. Assessment guidelines and full scoring techniques are in the validation sheets. Data is loaded in the form of a validity score table and a description of suggestions. This assessment includes; (a) presentation, (b) content, (c) language. The validity of the questions by experts is expressed in quantitative data, and then analyzed descriptively. The data obtained from the validation results are then analyzed using percentage analysis techniques as below.

$$VR = \frac{\sum_{i=1}^{n} \overline{V}_l}{n}$$

Annotation:
VR = number of rating levels
$\overline{V}_l$ = average score for each validator
n = number of validators

(adapted from Sudjana, 1995: 67).

The data above is then converted into descriptive quantities using assessment criteria as listed in Table-1 below.

Table-1: Validation criteria of HOTS questions package

Skore Range	Validity Criteria
$0 \leq VR < 1$	Not Valid
$1 \leq VR < 2$	Less Valid
$2 \leq VR < 3$	Valid
$3 \leq VR \leq 4$	Very Valid

b. Validity analysis of the question items
An instrument is declared valid if the tool can measure what it wants to measure (Suherman and Saondi, 2010: 47). The technique that can be used to determine the validity of a question is by correlating the scores obtained by each student in each question with a total score. According to Sugiyono (2011), the product moment correlation formula that used to determine the validity of question as follows:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (N\sum X)^2)(N\sum Y^2 - (N\sum X)^2)}}$$

Annotation:
$\sum X$ = total score of all students on the each question
$\sum Y$ = total score of all students on the test instrument
N = number of students
X = score of each student on the each question
Y = total score for each student
r_{xy} = validity

Annotaion:
Valid; if the value of $r_{count} > r_{table}$
Not valid; if the value of $r_{count} < r_{table}$

3. RESULT AND DISCUSSION

The logical validity was conducted by three expert by filling in the validation sheets. The logical validity was conducted by three expert by filling in the validation sheets. The average total scores of logical validity that obtained from the validation sheets are shown in the following Table.

Table-2: The logical validation of the HOTS question package

Validator	Average Score	Criteria
Validator 1	4,3	Valid
Validator 2	3,9	Valid
Validator 3	3,7	Valid
Average	3,97	Valid

The HOTS aspect includes C4, C5, and C6 indicators. The validation results from the three validators showed sufficient and good variation scores. So that the average score obtained is valid according to Table-2. Thus all question items can improve the students HOTS in analyzing, evaluating, and creating.

Likewise, the construction aspects of content, language, and presentation are declared valid with a good average score. The content aspect includes clarity on the instructions for work, conformity with the objectives of the research, and so on. Thus the material contained in the question according to the concept of physics, in accordance with the level of education, supports the understanding of physics concepts, and the choice of answers provided is logical. Formulation of questions in presentation aspects, answer key instructions, and supporting presentations such as images, tables, graphs are very good. In addition, the languages used are in accordance with enhanced and communicative spelling.

Based on Table-2, the average logical validation score that obtained from 30 questions by the three experts is 3.97 with valid criteria. It can be concluded that the question package can be used on the stage of empirical validation or tested on students in the three schools that have been determined.

Based on the results of observations and calculation by product moment correlation formula, obtained data in the form of the validity of C4, C5, and C6 question items, that are presented in Table-3 below.

Table-3: Validity of C4, C5, and C6 questions items

Question Number	Validity of the Question Package								
	SMAN 2 Jember			SMA Nuris Jember			MAN 1 Jember		
	C4	C5	C6	C4	C5	C6	C4	C5	C6
1	Not Valid	Not Valid	Valid	Not Valid	Valid	Valid	Not Valid	Not Valid	Valid
2	Valid	Not Valid	Not Valid	Valid	Valid	Not Valid	Valid	Valid	Valid
3	Valid	Valid	Valid	Not Valid	Not Valid	Valid	Valid	Valid	Valid
4	Valid	Valid	Not Valid	Valid	Valid	Not Valid	Valid	Not Valid	Not Valid
5	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid
6	Valid	Valid	Valid	Not Valid	Valid	Not Valid	Not Valid	Valid	Valid
7	Not Valid	Valid	Valid	Not Valid	Not Valid	Valid	Not Valid	Valid	Valid
8	Valid	Valid	Not Valid	Valid	Valid	Valid	Valid	Valid	Valid
9	Not Valid	Valid	Valid	Valid	Not Valid	Valid	Not Valid	Valid	Valid
10	Not Valid	Not Valid	Valid	Not Valid	Valid	Valid	Valid	Valid	Valid

Some items are declared not valid due to several factors. The first, because the items that are arranged are unclear, that is causing students feel confused to choose answer. Secondly, students as respondents not doing questions seriously so the questions that should get a high average score actually get a low average score. Based on these explanations, some items that are not valid in this study are due to the lack of clarity of the questions for students. So that students have difficulty to answering, finally the students answer carelessly.

According to Table-3, obtained the percentage of C4 items of SMAN 2 Jember and MAN 1 Jember are 60% valid and 40% not valid. Whereas at SMA Nuris Jember have balanced percentage between valid and not valid items, which are 50% of each. So that the average of C4 questions packages with the amount of 57% are declared valid. The physics questions package of C5 level of the three high school in Jember have the same percentage, that is 70% valid and 30% not valid. So in general the C5 questions package are declared valid. The physics questions package of C6 level of SMAN 2 Jember and SMA Nuris Jember have percentage of 70% valid and 30% not valid. Whereas in MAN 1 Jember the percentage are 90% valid and 10% not valid. So that the averaged of C6 questions packages with the amount of 77% are declared valid. Based on this explanation, it can be concluded that the physics questions package are valid to used for measure the high school students HOTS.

4. CONCLUSION

This study aims to develop a package of physics questions to measure students' HOTS. The question package consists of 30 questions by using three levels of Bloom include analyzing (C4), evaluating (C5), and creating (C6). The study products were developed through logical and empirical validation tests. Based on the results of logical validity by three experts, the average logical validation score that obtained from 30 questions by is 3.97 in valid criteria. It can be concluded that the questions package are valid from all aspects. Whereas, the empirical validity was tested on three high schools in Jember that is SMAN 2 Jember, SMA Nuris Jember, and MAN 1 Jember. Based on the tested, the average of C4 questions packages with the amount of 57% are declared valid. The average of C5 questions package with the amount of 70% are declared valid, and the averaged of C6 questions packages with the amount of 77% are declared valid. Based on that data, it can be concluded that the physics questions package are valid to used for measure the high school students HOTS.

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