

## Development of Problem-Based HOTS (Higher Order Thinking Skill) Question Instruments on Class VIII Pressure Material

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### ABSTRACT

#### KEYWORDS:

Aiken  
Development  
HOTS  
Instruments  
Pressure

The HOTS question instrument is important in learning. Through HOTS students are trained to learn things at a higher level, think critically in receiving information, think creatively in problem solving, and make the right decisions in complex situations. These various abilities are certainly needed in the face of changing life dynamics. This situation requires us to continue to adapt, so the ability of HOTS is very important to be developed as an effort to improve the ability to think at a higher level and prepare ourselves to face problems in life. This makes the author interested in developing a problem-based HOTS problem instrument on pressure material. This research uses R&D techniques that refer to Thiagarajan's (1974) 3-D procedural model. The instrument consists of 10 description questions that refer to 5 indicators, namely: analyzing; Evaluate; Created; Troubleshooting; and critical thinking skills. The instrument was validated by 7 experts with the validity analysis technique Aiken (1950). The results of the analysis obtained: suitability of the question with bloom's taxonomy (88%), suitability of the question with the answer (86%), feasibility of language (85%); and the feasibility of presenting the question (84%). This proves that all aspects of the instrument are declared valid because  $V_{\text{count}} > V_{\text{table}}$  Aiken,  $V_{\text{table}}$  Aiken 75%, so it is concluded that this instrument is declared valid and feasible to be used to test the higher-order thinking skills of learners.

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## 1. INTRODUCTION

The teaching and learning process that has been carried out between teachers and students can be measured for success through the provision of learning evaluation, which is an assessment or measurement of the ability of students, (Permatasari, A, 2014). Teachers in assessing learning outcomes require assessment instruments in the form of questions (Dewi, 2016). An instrument is a tool that can be used to assess how well learners have learned certain skills (Desilva 2020; Septiani et al, 2022).

Making question instruments certainly adjusts to the learning indicators that have been set based on learning objectives. Learning applied in Indonesia has several goals that must be achieved, these goals include: (1) critical thinking and problem solving, (2) communication and collaboration skills, (3) creativity and innovation, (4) technology and communication literacy, (5) contextual learning. (6) media and information literacy, (Gradini, 2019). Based on the goals that must be achieved, it can be seen that higher-order thinking is one of the important points that must be developed in students and there needs to be measurement at the end of each lesson. This is supported by a survey conducted by an expert in the United States regarding the needs in the world of work. The survey shows that critical thinking skills are at the top, then new mastery of information, the ability to think collaboratively and innovatively, (Angraini, 2019).

Based on the learning objectives to be achieved, the assessment instrument of student learning outcomes must be adjusted, by means of questions given must be based on HOTS (Higher Order Thinking Skill). Lewis and Smith (1993) state that higher-order thinking skills (HOTS) include critical thinking, creative thinking, problem solving, and decision making. Meanwhile, according to Anderson and Krathwohl (2001) the cognitive process of HOTS includes analyzing (analyzing) or C4 equivalents in Bloom's Taxonomy, evaluating (evaluating) or C5 equivalents in Bloom's Taxonomy, and creating (creating) or C6 equivalents in Bloom's Taxonomy. So the author took 5 indicators in the assessment of higher-order thinking skills on pressure material and its application in life for class VII. HOTS indicators are: analyze (C4); evaluate (C5); create (C6); Troubleshooting; critical thinking skills. Based on the opinions of experts, it can be concluded that the HOTS problem instrument is not just a problem that relies on memorization skills for students, but measurement using HOTS questions is more about how students think about a certain situation that is packaged in the form of a problem so that students must analyze, evaluate, create, think critically, or have to find solutions to solve problems well.

## **2. METHODS**

The type of research used in this research is Research and Development (R&D) which means research and development. R&D research is used to produce certain products and test the effectiveness of these products (Sugiyono, 2014: 407). This R&D study has three stages: definition, design, and development, which refers to Thiagarajan's (1974) 3-D procedural model.

### *2.1. Define Stage*

At the defining stage, the author defines the needs in the field by collecting various information through questionnaires that are distributed online in various schools in Surakarta. Junior high school science teachers fill in the obstacles faced through the google form provided by the researcher. In addition, respondents also revealed the desired product developments in the future so that learning can be maximized in the pandemic era by utilizing various existing technologies to improve students' higher-order thinking skills (HOTS).

### *2.2. Design Stage*

At this design stage, it is hoped that the resulting question instrument can measure the higher-order thinking skills of students after learning science class VIII pressure material. Here are some stages of design carried out by researchers:

#### *2.2.1. Test preparation*

Test instruments that fall into the HOTS (Higher Order Thinking Skill) category are questions that accompany students in thinking according to Bloom's taxonomy, namely C4 analysis, C5 evaluation, and creating C6, Anderson and Krathwohl (2001). In addition, Lewis and Smith (1993) add that higher order thinking skills (HOTS) include critical thinking and problem solving. Therefore, the author in compiling an evaluation test instrument includes 5 indicators, namely C4 to C6, critical thinking, and problem solving. The preparation of questions is equipped with matrices, grids, and the results of the analysis of learning objectives on pressure material and its benefits in the daily life of grade VIII junior high school.

### 2.2.2. *Format selection*

After the stage of determining the type of HOTS question based on the needs analysis, the researcher determines a good and appropriate format. The author designs the questions attractively in the form of pictures so that students can imagine according to the application in their daily lives. The number of questions developed is 10 points by taking into account the indicators that have been set as a benchmark for students' higher-order thinking skills (HOTS). Preparation pays attention to the layout, size, and clarity of the image so that the problem can be understood appropriately by students.

### 2.2.3. *Early Desai*

The instruments that have been made by researchers then assess their feasibility by validators who are experts in the fields of language, ISIS feasibility, and presentation feasibility. After going through reviews and assessments from experts, the author received a lot of suggestions and input so that the question instrument was revised to be better according to the advice of experts. The results of the revision of the HOTS (Higher Order Thinking Skill) question instrument become Prototype 1 which is ready to be used as a measuring tool for evaluating the learning outcomes of grade VIII students on pressure material and its application in everyday life.

## 2.3. *Develop Stage*

This development stage aims to produce prototypes or products that have been developed and then validated and input by validators, lecturers, experts, and practitioners. At the development stage, this is in the form of expert appraisal, which is to assess the validity of the prototype that has been developed using a validation questionnaire. Expert validation was carried out by 2 expert lecturers and 6 practitioners. Expert lecturers are lecturers of S2 Science Education at Sebelas Maret University, practitioners consist of 6 including: 2 science teachers of SMP Negeri 26 Surakarta; 3 science teachers of Al Abidin Islamic Junior High School Surakarta; and 1 teacher Indonesian Al Abidin Islamic High School Surakarta. Each practitioner was chosen by the researcher because he has experience in teaching for approximately 10 years.

On the validity of the researcher used the analytical technique provided by Aiken. In 1985, Aiken proposed the concept of content validity in more detail. There are three levels that determine the quality of the validity of the content, namely sensual E, useful but not essential (G), and not necessary (T). In this study the author used the V Aiken formulation written by (Azwar, 2012, p. 113; Aiken, 1985, p. 133) with the following formulation:

$$V = \frac{\sum(ri - lo)}{[n(c - 1)]}$$

Information:

r = number given by the appraiser

lo = lowest validity assessment number

c = highest validity assessment number

n = number of experts & practitioners performing assessments  
i = integers from 1,2,3 to n

The validity classification range corresponds to the following table 1.

**Table 1.** Range of Validity Categorization

Quality	Score Range	Category
E	4 Score 5	Worth using without revision
G	Score 3	Worth using with revisions as suggested
T	1 Score 2	Not worth using

The results of the question instrument are said to be valid and feasible to be used as a measure of students' higher-order thinking skills (HOTS) when the results  $V_{\text{count}} > V_{\text{table aiken}}$ .

### 3. RESULTS AND DISCUSSION

The HOTS (Higher Order Thinking Skill) question instrument that has been made by researchers is then tested for feasibility and validity to experts. The aspects assessed are the content aspect (the suitability of the question with the answer and the suitability of the question with Bloom's taxonomy), the language aspect, and the presentation aspect. Researchers use Aiken analysis techniques. For the results of the validator assessment of the content aspect of the HOTS question instrument product, the pressure material and its application in life for grade VIII junior high school can be seen in table 2 (suitability of the question with bloom's taxonomy) and table 3 (suitability of the question with the answer).

**Table 2.** The results of the validation of HOTS instrument products in the aspect of conformity of questions with Taxonomy Bloom

Question Point	V Aiken	Information
1	0.91	Valid
2	0.88	Valid
3	0.88	Valid
4	0.94	Valid
5	0.81	Valid
6	0.91	Valid
7	0.81	Valid
8	0.91	Valid
9	0.88	Valid
10	0.91	Valid
<b>Average</b>	0.88	
<b>Percentage</b>	88%	

Based on the calculation results, it was found that question items number 1 to 10 were all above the Aiken index of 0.75 so that an average of 0.88 or 88% of the conformity of the questions with Bloom's taxonomy was obtained from C4, C5, C6, critical thinking, and problem solving. When  $V_{\text{count}} > V_{\text{table}}$  or  $0.88 > 0.75$  then it can be stated that the instrument is valid and feasible to be used as a measure of higher-order thinking skills.

**Table 3.** The results of the validation of the HOTS instrument are aspects of the suitability of the answer questions with the questions

Question Point	V Aiken	Information
1	0.78	Valid
2	0.78	Valid
3	0.94	Valid
4	0.91	Valid
5	0.88	Valid
6	0.88	Valid
7	0.78	Valid
8	0.91	Valid
9	0.86	Valid
10	0.88	Valid
<b>Average</b>	0.86	
<b>Percentage</b>	86%	

Based on the calculation results, it was found that question items number 1 to 10 were all above the Aiken index of 0.75 so that an average of 0.87 or 87% of the match with the answers was obtained. When  $V_{\text{count}} > V_{\text{table}}$  or  $0.87 > 0.75$  then it can be stated that the instrument is valid and suitable for use as a measurement of higher order thinking skills (HOTS).

After the feasibility of the content, the validator also assesses the HOTS question instrument of class VIII material about pressure and its application in life in terms of language. The following results of expert validators can be seen in table 4.

**Table 4.** The results of the validation of HOTS questions from the language aspect

Question Point	V Aiken	Information
1	0.81	Valid
2	0.78	Valid
3	0.91	Valid
4	0.84	Valid
5	0.91	Valid
6	0.88	Valid
7	0.84	Valid
8	0.88	Valid
9	0.81	Valid
10	0.88	Valid
<b>Average</b>	0.85	
<b>Percentage</b>	85%	

Based on the calculation results, it was found that question items number 1 to 10 were all above the Aiken index of 0.75 so that an average of 0.85 or 85% of the feasibility of the language used in the question was obtained. When  $V_{\text{count}} > V_{\text{table}}$  or  $0.85 > 0.75$  then it can be stated that the instrument is valid and suitable for use as a measurement of higher order thinking skills (HOTS).

The last and no less important aspect in the validation process is the feasibility test of the questions in terms of presentation. Both font size, image selection, image clarity, image placement and so on related to the presentation of question instruments. These results can be seen in table 5 as follows.

**Table 5.** The results of the validation of the HOTS question from the aspect of material presentation

Question Point	V Aiken	Information
1	0.84	Valid
2	0.88	Valid
3	0.88	Valid
4	0.81	Valid
5	0.88	Valid
6	0.81	Valid
7	0.88	Valid
8	0.78	Valid
9	0.84	Valid
10	0.85	Valid
<b>Average</b>	0.84	
<b>Percentage</b>	84%	

Based on the calculation results, it was found that question items number 1 to 10 were all above the Aiken index of 0.75 so that an average of 0.84 or 84% of the feasibility of the language used in the question was obtained. When  $V_{\text{count}} > V_{\text{table}}$  or  $0.84 > 0.75$  then it can be stated that the instrument is valid and suitable for use as a measurement of higher order thinking skills (HOTS).

#### 4. CONCLUSIONS

From this study, it can be concluded that the level of validity or feasibility achieved by the HOTS question instrument in learning science pressure material and its application in everyday life for class VIII is declared valid and feasible to be used as a measure of students' higher-order thinking skills. This is evidenced by the results of V aiken analysis, the suitability of the question with bloom's taxonomy (88%), the suitability of the question with the answer (86%), the feasibility of the language (85%); and the feasibility of presenting the question (84%). This proves that all aspects of the instrument are declared valid because  $V_{\text{count}} > V_{\text{table}}$  Aiken,  $V_{\text{table}}$  Aiken 75% or 0.75.

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