

# Developing HOTS-Based Assessment Instrument for Primary Schools

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**Abstract** — This study aims to develop valid, reliable, and practical HOTS-based assessment instrument for primary school. The Assessment Instrument developed is in the form of multiple-choice test which consists of 25 questions and it was developed based on the competencies of the fifth-grade elementary school subjects. The assessment was developed by using ADDIE model: (1) Analyze; (2) Design; (3) Develop; (4) Implement; and (5) Evaluate. This study involved the course material experts and linguists, teachers and the fifth-grade students of the elementary school. Instruments used were the validation instruments for course material expert and linguist and the instrument of product practicality for teachers. The data were in the form of data validation from the course material experts and linguists, the practical test result from the teachers, and from tryout results. Finally, based on the results from experts, product testing, and tryout, it is found that the HOTS-based assessment instrument developed which consists of 17 items was in the category of valid, reliable, and practical and thus, it is appropriate to be used as HOTS-based assessment for the fifth grade elementary school students.

**Keywords** — assessment instruments, HOTS; multiple choices, fifth grade students

## I. INTRODUCTION

Teaching is one of the important factors in developing students' learning. Teaching, indeed, is a process of interaction between students and students, students with learning resources and students with teacher [1]. Teaching and learning activities will be meaningful for students if they do them in a comfortable environment which provides a sense of security for students. Learning is an individual and contextual process, which means that the learning process occurs inside the individuals in accordance with their development and environment. Therefore, learning by doing can be more meaningful than just by hearing explanations.

Elementary school students around 6-12 years are relatively very young. However, it is stated in the 2013 curriculum that elementary school students are required to have the ability to think critically so that they will be able to solve their problems. These days, students are expected to be able to process information and make right decisions. Students need to develop ways of thinking and reasoning

logically. This way of thinking is categorized as High Order Thinking Skills (HOTS).

HOTS are an important aspect of learning. The ability to think at a higher level is a process of analyzing, reflecting, giving arguments (reasons), applying concepts to different situations, composing and creating [2]. HOTS is not just the ability to remember, know, or repeat but it is more than that, it is the competences in problem solving, critical thinking, creative thinking, reasoning and decision making [2] [3]. The ability to think at a higher level is one of the important competencies needed to face the challenges in the 21<sup>st</sup> century.

Considering the important position of HOTS in learning, teachers need to have knowledge and competence that can help in developing high order thinking skills of their students [4]. One of the competencies that teachers need to possess is a competence in developing HOTS-based questions in learning. HOTS questions can be applied during the teaching and learning process and in evaluating the learning outcomes.

Based on these ideas, this study was carried out and it was about the implementation of HOTS in the elementary school in Mataram Indonesia. The preliminary observations at several public elementary schools in Mataram show that teachers still had difficulties in creating HOTS questions. The difficulties experienced by elementary school teachers are due to: (1) the lack of understanding of HOTS-based assessment concept; (2) low level of understanding of Operational Verbs of Bloom's Taxonomy; (3) inability to determine basic competencies that can be developed into HOTS-based questions; (4) few practical references about HOTS-based question construction; and (5) the training conducted by some related agencies is still theoretical.

Considering the facts that there is still a gap between the ideal situation and the empirical situation in the field, it is necessary to develop qualified HOTS-based assessment instruments so that elementary teachers can use them to develop the thinking skills of their students. The assessment instrument developed in this study was in the form of multiple-choice questions accompanied by the criteria and

answer key so that it could be a reference for the teacher in developing HOTS-based questions.

## II. METHOD

This is a research and development with ADDIE model stages: (1) Analyzing, (2) Designing, (3) Developing, (4) Implementing, and (5) Evaluating [5]. The reasons for choosing the ADDIE development model are (1) the steps in the ADDIE model are specific and clear for the development of HOTS-based assessment instruments, (2) revisions are made almost every step of the development, and (3) it has compatibility with product characteristics in the form of a HOTS-based assessment instrument for grade V elementary school applying the curriculum 2013. This research involved a course material expert and a linguist, a primary school teacher, 38 students of the fifth grade at SDN 40 Cakranegara, Mataram.

The instrument used was the validation instruments for course material expert and linguists, and also the product practicality instrument for teacher. The data were gathered from the validation of course material expert and linguist, product practical test results, and the results from the tryout. Data were analyzed by using quantitative and qualitative techniques. Material expert validation data were analyzed by using the validity formula of Akbar adaptation product [6]. Practicality data were analyzed by using practicality of Akbar adaptation product [6]. The empirical validity data were analyzed by using the correlation formula from Pearson Product Moment. Reliability data were analyzed by using the Cronbach Alpha formula. Analysis of empirical validity and reliability data was assisted with the SPSS 17.0 for Windows computational program. The data obtained were used to find out the level of validity, reliability, and practicality as a prerequisite of the eligibility HOTS-based assessment instruments being developed for the fifth-grade elementary school students.

## III. RESULTS AND DISCUSSION

The development stages in this research are in accordance with the steps of ADDIE, including the stages of analyzing, designing, developing, implementing, and evaluating. The results and discussion at each stage in this study are described as follows:

### A. Stage of Analyzing

In the stage of analysis, an initial identification was made about the gap between the empirical conditions of assessment in learning at the present school and the desired results (ideal in theoretical and juridical). Identification was done by observation, interview, and preliminary study at elementary school in Mataram. To reinforce the facts of the initial identification results, a literature review was conducted on HOTS-based assessment theory in elementary schools, ministry policies related to HOTS-based assessment in elementary schools, and reviewing the results of previous researches dealing with the similar topic [5].

The identification result shows that there is still a gap between ideal theoretical and juridical studies towards the empirical facts in the field. Elementary teachers still face some obstacles and difficulties in implementing and developing HOTS-based assessment instruments for the fifth-grade students. It needs solution to overcome the gap

and the solution is to carry out the development of HOTS-based assessment instruments that have been tested for their validity, reliability and practicality so that they are suitable to be used by the elementary school teachers, especially those teachers in grade five.

### B. Step of Designing

The second stage of this development research is designing stage. At this stage, a question grid was developed in the form of competency achievement indicators derived from basic competencies for the fifth-grade elementary school [7], instrument design, number of items, and answer keys due to the instruments developed were in the form of multiple-choice questions. In this process, the design was obtained from the HOTS-based assessment instrument in the form of questions grid (blueprint). Design grid is important as a guide to facilitate teachers in developing the assessment instruments [8] [9].

Indicators of questions in the developed grid are derived from the basic competencies of three subjects at grade five, namely Indonesian language, natural science, social science, and civics education subjects. The details of the indicator distribution can be seen in table 1 below.

TABLE I. HOTS-BASED ASSESSMENT INSTRUMENT GRID

Subjects	Basic Competency 3	Cognitive Level	Numbers of Indicators	Number of Questions
Indonesian language	3.6	C4 – C5	5	5 items
Natural Science	3.2, 3.3, 3.4	C4 – C5	4	10 items
Social Science	3.2, 3.3	C4 – C5	4	4 items
Civics Education	3.1, 3.2, 3.3	C4	6	6 items
<b>Total</b>			<b>19</b>	<b>25 items</b>

### C. Stage of Development

The stage of development was carried out by arranging HOTS-based assessment instrument products for the fifth-grade elementary school students in the form of multiple-choice questions. Products are arranged and developed according to product specifications designed on a grid. The stage before result validation was producing an initial product or prototype. The purpose of this development stage is to produce an initial product/ prototype and validate the prototype that has been developed to experts [5]. This stage consists of three more sub-stages: (a) producing a prototype and its accessories; (b) validating prototype by experts and revising; and (c) planning tryout in the field for the product resulted from validation.

#### 1) Sub-stage 1: Development of Prototypes Products

The initial sub-stage is the product development process based on the grid design. The initial product was developed in the form of multiple-choice questions to train the fifth-grade students in elementary schools to apply higher-order thinking skills. The questions also include the grid, answer keys, and guidelines for score processing for the teacher.

In this research context, HOTS questions are arranged by using simple stimuli but close to students' lives such as awareness about garbage, water hygiene, soil, air in the city

of Mataram, and also simple daily life events such as social interactions, economic activities, and commercial transaction at Cakranegara market. In addition to being able to develop students' HOTS, this way can make students sensitive to everyday events and related them to the learning material at school to find solutions. There are 25 number of questions developed in this stage.

### 2) Sub-stage 2: Expert Validation and Revision

The second sub-stage was carried out to test the content validity and construct. The content/curricular validity is related to the accuracy of the instruments arranged in measuring the material that has been taught [10] meanwhile the construct validity shows how far the items arranged in the assessment instrument can measure what should be measured [11].

HOTS-based test prototypes that have been developed are tested to elementary and language materials experts to assess their level of validity. The assessment uses a validation questionnaire that has been developed at the design stage as a measurement tool to test product worthiness. The results of the prototype validation from material expert and linguist are presented in table 2.

TABLE II. RESULTS VALIDATION ON ELEMENTARY AND LANGUAGE MATERIALS EXPERT

Subject Validation	Indicator	Score	Percentage of Validity	Criteria
Elementary and Language Materials Expert	Relevance, Accuracy, and Language Clarity	87,5	87,5%	Very Valid

In addition to quantitative data, qualitative data were also obtained in the form of suggestions for the development of HOTS questions. The input and suggestions from the validator for the questions developed are: (1) to simplify the use of words and sentences due to the questions are for elementary students; (2) to pay attention to the correct use of punctuation such as periods and commas; (3) to delete a number of questions that are less relevant according to input and suggestions; and (4) to pay attention to several answer choices so that students will not be confused with it (ambiguous answer choices).

Based on the score validation from the elementary school material expert and linguist described in table 3, it can be stated that the instrument developed was classified as very valid, reaching 87.5. The content/curricular validity has been fulfilled, which mean that the instruments developed have represented material in the curriculum taught to the fifth-grade elementary school students. The results of the validity test by the experts also showed that the instrument was appropriate to be used to record and train students to apply HOTS. The questions developed in terms of constructs are in accordance with the concept of HOTS-based assessment. The intended construct is the HOTS at the C4-C6 cognitive levels based on Anderson's revised Bloom taxonomy [12].

### 3) Sub-stage 3: Planning Field Tryout

The third stage is planning tryout for products that have been revised based on expert validation testing. This tryout was carried out in grade five of the SDN 40 Cakranegara. This stage involved one teacher and 38 students of grade five

as the main subject of this study. Data collected on this stage were about practicality of the instrument, empirical validity and instrument reliability data.

### D. Stage of Implementation

This stage is the product implementation in the form of 22 items of HOTS which are declared valid based on the expert validity test. This stage aimed at testing the empirical validity, reliability, and practicality of the product.

Empirical validity refers to empirical facts (practical experience). Data about empirical validity was done through testing assessment instruments developed in the teaching practices at schools [6] [10]. The empirical validity analysis data are described in the following table 3.

TABLE III. RESULTS OF EMPIRICAL VALIDITY TEST ANALYSIS

Validity Categories	Number of Items	Percentage (%)	Calculated Score	
			Lowest	Highest
Valid	17	77%	0,354	0,696
Not Valid	5	23%	0,094	0,316

The results of the empirical validity show that 17 items were declared valid and 5 items were declared invalid. Valid items obtain high Pearson Product Moment  $r$  coefficients, which are at the range of 0.354 - 0.696. Whereas for the invalid items, the *coefficient r* value is at the range of 0.094 - 0.316. The percentage of valid items is 77% and invalid instruments are 23%. The invalid questions were deleted. Therefore, the number of items in the final product that can be used to train the fifth-grade elementary school students for their HOTS amounts to 17 items. Invalid items are not only found in the content of the lesson, but evenly distributed, one item in the social studies content, one question in the civic content, and three questions in the science content so that the assessment instrument can still be used to measure HOTS in the 4 subject areas developed.

Product reliability relates to the constancy and stability of an instrument producing data about students' learning processes and outcomes [10] [13]. The results of the reliability analysis of the 17 items of HOTS are presented in table 4.

TABLE IV. HOTS BASED INSTRUMENT RELIABILITY TEST RESULTS

Number of valid items	Cronbach's Alpha Coefficient	Predicate
17	0.857	Reliability

The calculation results of the product reliability coefficient based on the Alpha Cronbach coefficient ( $\alpha$ ) equal 0.857. The reliability coefficient criteria of this instrument are in the high category, therefore the HOTS-based assessment instrument can be said to be reliable. These results are in line with [13] that the instrument is said to be reliable if tested on the same subject repeatedly, the results will be relatively the same, consistent, stable, and not statistically different.

Product practicality refers to the extent to which the instruments developed are easy to use and implement and also easy to manage. An instrument is said to be practical if

the teacher finds no difficulties in planning, implementing, examining, interpreting results, reporting, and storing the instrument [10], [11], [13].

The product practicality test is carried out through a direct assessment by the teacher towards the instrument developed. The instrument used is the instrument practicality from the teacher. The results of the product practicality assessment data are detailed in table 5.

TABLE V. RESULT OF PRODUCT PRACTICALITY

Subject of try	Indicator Practicality	Practicality Score	Percentage (%)	Criteria
Grade V teacher	Practicality, Clarity, and Completeness	86	86%	Very Practical

The qualitative data of the assessment practicality results in the form of suggestions and criticisms from the teacher are the use of punctuation (.....), the point where each question ends with a word *is* and *that is* must be consistent. In addition, the use of 4 dots at the end of each question must also be in accordance with the rules of writing questions. Based on this input, the questions were revised in the editorial part of the sentence and punctuation suggested by the teacher. The revision did not reduce the items and the content of the questions in a broad sense.

Based on the results of practicality assessment from practitioners namely the fifth-grade teacher at SDN 40 Cakranegara, it was found that a practicality score of 86 was obtained. Based on these values, the products developed were categorized as very practical. The high practicality value indicates that the instrument is appropriate to be used to train the fifth-grade elementary school students to be able to think at a high level because the instrument is easy to use, easy to understand, easy to process and to report the results.

This finding is in accordance with the results of previous researches dealing with the development assessment in elementary schools that found that the assessment instruments developed are appropriate to be used to record and train students' HOTS because the instruments are easy to apply, understand, and process and also to be reported by the teacher in grade five [14] [15].

#### E. Stage of Evaluation

Evaluation was done through clarification of data obtained from the elementary school material expert and linguist and also data from the practicality questionnaire from the teacher and data dealing with student work in order to see the empirical validity and reliability. From the validation data analysis, it is found a description of the feasibility product seen from the assessment theory of content and construct validity, as well as the feasibility in terms of language. The product was revised based on the results of the assessment and expert's input for conducting field tryout. The final evaluation was carried out based on the results of the practicality test analysis and input from the teacher and also from the results of the analysis of the empirical validity test. The revision at this stage produced a final HOTS-based assessment instrument that had been tested for its validity, reliability and practicality so that it was suitable to be used in the field.

## IV. CONCLUSION

The validation results from the elementary school material expert and linguist indicate that the HOTS-based assessment instrument developed was valid. It can be seen from the percentage of values given by the validators on the aspects of construct validity and the content that is categorized as very valid. From 25 questions in the initial prototype, 22 questions were categorized valid according to expert judgment. In addition, the questions were also tested at SDN 40 Cakranegara and the result shows that the HOTS-based assessment instrument developed obtained a high percentage for empirical, reliability, and practicality values. However, there were only 17 questions declared to be valid from those 22 questions. Based on the analysis that has been done, it is concluded that the HOTS-based assessment instrument developed for the fifth-grade elementary school students is valid, practical, and reliable so that it is feasible to use in training the fifth-grade elementary school students to work on HOTS-based questions.

The development of HOTS-based assessment instruments has not been done much by teachers in primary schools. Therefore, further research and development is needed in order to create a wider HOTS assessment instrument especially for grades 4, 5, and 6 Elementary Schools. Moreover, variations in the level of thinking need to be further developed not only at the C4 and C5 levels but also at the level of C6 thinking. Future studies are expected to employ the validity test which involves more experts, and large-scale field tryout, and to disseminate the product in the form of books or question banks based on HOTS for elementary school students.

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