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Development of Assessment Instruments Based on Higher order Thinking Skill (HOTS) to Measure Critical Thinking Students of Class XI IPS Private Senior High School of Sultan Iskandar Muda Medan TP 2020/2021

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Abstract

The development of a HOTS-based assessment instrument in the form of a test is prepared based on an analysis of the needs of students and teachers in economics subjects for the 2020/2021 academic year in the 2013 curriculum student critical. This research is a development research (R and D) with a Borg and Gall development model that has been adapted to research needs Based on the results of the study, it shows that the results of the evaluation expert validation for multiple choice questions of 88% are in the very good category, for essay questions 87% are in the very good category, the results of material expert validation are 84% in the very good category, the results of response validation the teacher is 88% very good and the student response validation is 91% in the very good category. For the results of the analysis of the validity of multiple-choice questions and descriptions, they are in the valid and reliable category, have a level of difficulty in the medium category and have different power of questions, namely 8 questions in the very good category, 8 questions in the good category and 9 questions in the sufficient category. The results of the analysis of students' HOTS questions have an average of 66% in the sufficient category, and the results of the students' critical thinking questionnaire have an average of 68.8% are in the critical enough category. This shows that the HOTS-based assessment instrument is effective in measuring students' critical thinking skills seen from the results of the HOTS-based assessment instrument analysis which is directly proportional to the results of students' critical thinking questionnaires.

Keywords
assessment instruments; HOTS; critical thinking

I. Introduction

HOTS as a critical thinking process in the context of learning is to form students who are able to think logically (reasonably), reflectively, and make decisions independently. In line with opinion(Arifin, 2018)that students who think critically consistently strive to live rationally, fairly and empathetically even if faced with critical thinking problems will encourage them to continue learning. The results of research conducted by Redhana & Liliasari(Hasan et al., 2020)Critical thinking is learning high-level thinking skills that provide opportunities for students to practice their abilities through assessment or practice. In economics learning objectives, students are expected to have the ability to think critically, process, reason, present, create independently, effectively, and creatively and be able to use

methods in accordance with the rules of economic science. Therefore, it can be concluded that students' critical thinking skills can be trained through HOTS-based learning and assessment instruments to improve their critical thinking skills.

Based on the results of initial observations made by researchers at the Sultan Iskandar Muda Private High School, Medan, it was found that the assessment instrument made by the economics teacher did not contain a grid of questions first, and immediately made test questions in the form of multiple choice and descriptions. Even the description test does not include the score of each weight of the questions made. A good and correct description test instrument should include the weight of the questions to determine the level of difficulty of each question and also students can find out the suggestions for each question score. Therefore, in the preparation of the test instrument, there is a mismatch of indicators in the Competency Standards (SK) and Basic Competencies (KD) that must be achieved by students.

Other evidence from the results of the study by researchers, that the questions on economic subjects that are made tend to test more aspects of remembering while the questions that train students' higher-order thinking skills are not yet available. For example, one of the multiple-choice questions regarding the aspect of considering the instrument made by the economics teacher is "Tax rates with a fixed percentage for each tax imposition are called". Or one of the questions in the form of description, namely "Write down the characteristics of taxes?". It can be seen that the form of the questions made only examines the memory aspect, has not tested the cognitive level of higher-order thinking skills. Furthermore, the results of the analysis of UTS items for Economics subjects as many as 30 multiple choice questions using the ANATES application version 4.0.10 which are contained in the table below, namely:

Table 1. Analysis of UTS Questions for Economics Class XI IPS Semester I Sultan Iskandar Muda Private High School TP 2020/2021

Analysis	**Criteria**	**Number of Questions**	**Percentage**
Validity	Valid	9	30%
	Invalid	21	70%
Difficulty Level	Easy	14	46.7%
	Currently	13	43.3%
	Hard	3	10%
Distinguishing Power	Well	2	6.7%
	Enough	5	16.7%
	Bad	23	76.6%

From the table above, it can be seen that the assessment instrument made by the economics teacher at the Sultan Iskandar Muda Private High School, Medan is still classified as poor. This can be seen from the item analysis, namely 70 percent of invalid questions, the level of difficulty of more questions that are easier, and the distinguishing power of questions with poor criteria, which is 76.6 percent, meaning that more questions need to be corrected to meet the elements of the feasibility of the assessment instrument. . This is in line with Arifin's findings(Hutapea & Sudrajat, 2019) In developing assessment instruments, the teacher's ability to develop assessment instruments is still weak, namely 75 percent of the questions are invalid, in the reliability test the questions are in the sufficient category, most of the questions are in the easy category, namely 42.5 percent, 40 percent are moderate, 17.5 percent are in

the difficult category and have 7.5 percent is very bad, 13 percent is adequate, 15 percent is good.

Another fact that the researcher can attach is the results of the mid-semester exam (UTS) of economics subjects carried out by students from the questions contained in the table below, namely:

Table 2. UTS Results for Class XI Social Sciences Class XI SMA Private Sultan Iskandar Muda TP 2020/2021

Score	Category	UTS Sem I TP Results 2020/2021	
		Frequency	Percentage
90 – 100	Very good	5	4.2%
80 – 89	Well	19	15.8%
70 – 79	Enough	38	31.7%
< 69	Not enough	58	48.3%
Amount		120	100%

From the table above, it can be concluded that the results of the mid-semester exam (UTS) are not satisfactory, there are 48.3 percent of students who are still below the minimum completeness criteria (KKM). This of course is not only determined when the learning process takes place, but when the test instrument made meets the correct rules, it will affect the learning outcomes as well. For example, the construction of questions that are not easily understood by students, the level of distractor answers, and so on.

In addition, an assessment instrument that is oriented towards higher order thinking skills is important to develop because it follows the progress of science and technology specifically to train students' critical thinking. This is in line with the opinion of Richmond (2007) in his research which states that good thinking skills can be a strong asset for students in Asia to be able to face complex problems that exist in the development of modern times. Therefore, the type of questions asked by the teacher should affect the thinking skills of students. Questions and assignments must be able to explore the potential and ability of students to think critically.

II. Review of Literature

2.1 Development of HOTS Assessment Instruments

Development is a process / way, the act of developing. In term of development, it shows that an activity produces a new tool or method, during which the activity will continue to be evaluated and improved to improve quality. So that development can be defined as a plan to develop something that already exists in order to improve the quality of more advanced. (Ediyani, M. et al. 2020)

In improving the 2013 curriculum, the assessment standard provides room for the development of an assessment instrument that measures Higher Order Thinking Skills (HOTS). The development of cognitive assessment instruments in the form of HOTS questions requires various criteria, both in terms of the form of the questions and the content of the subject matter. The technique of writing HOTS questions in the form of multiple choice or descriptions is generally the same as writing low-level questions, but there are several characteristics that distinguish them.

In Bloom's Taxonomy of cognitive domains that have been revised by Anderson and Krathwohl (2001), there are six levels of learning activities as a starting point in developing assessments, namely: remembering (remember-C1), understanding (understand-C2), applying

(apply-C3), analyzing (analyze-C4), evaluate (evaluate-C5), and create (create-C6). For HOTS questions, in general, they measure abilities in the realm of analyzing (analyze-C4), evaluating (evaluate-C5), and creating (create-C6) as described in the following table.

Table 3. Cognitive processes according to Anderson & Krathwohl

Cognitive Process			description
C1	LOTS	Remember	Retrieving relevant knowledge from memory
C2		Understand	Building meaning from the learning process, including oral, written, and graphic communication
C3		Apply	Performing or using procedures in unusual situations
C4	HOTS	Analyze	Breaking down material into its parts and determining how the parts are related between the parts and to the structure or purpose of the whole
C5		Evaluate	Make judgments based on criteria or standards
C6		Create	Putting elements together to form a coherent or functional whole; rearrange elements into new patterns or structures

Source: Cognitive Processes of Bloom's Taxonomy Revised Anderson and Krathwol, 2001

In addition to analyzing, evaluating and creating from Bloom's Taxonomy, other terms are also known to indicate HOTS thinking such as critical thinking, problem solving, and creative thinking. However, in the operational order, it is necessary to differentiate so as not to overlap. For example, when creating, critical thinking and creative thinking are also involved. Similarly, when solving problems, analysis, evaluation, creative thinking can also be involved.

In selecting operational verbs (KKO) to formulate indicators for HOTS questions, it should not be trapped in the KKO grouping. For example, the verb "determine" in Bloom's Taxonomy is in the realms of C2 and C3. In the context of writing HOTS questions, the verb "determine" may be in the realm of C5 (evaluate) if to determine a decision is preceded by a thought process analyzing the information presented on the stimulus then students are asked to determine the best decision. Even the verb "determine" can be classified as C6 (creating) if the question requires the ability to develop new problem-solving strategies. So, the realm of operational verbs (KKO) is strongly influenced by what thought processes are needed to answer the questions given.

To write HOTS items, one must be able to determine the behavior to be measured and formulate the material that will be used as the basis for the question (stimulus) in a certain context in accordance with the expected behavior. Therefore, in writing HOTS questions, mastery of teaching materials is needed, skills in writing questions (construction questions), and teacher creativity in choosing question stimuli. The following are the steps in preparing HOTS questions:(Setiawati et al., 2018) is :

1. **Analyzing KD that can be made HOTS questions**
   First, the teachers choose KD which can be made HOTS questions. Not all KD models can be made HOTS questions. Teachers independently or through the KKG/MGMP forum can conduct an analysis of the KD that can be made HOTS questions.
2. **Compiling a grid of questions**
   The HOTS question writing grid is intended for teachers to write HOTS questions. In general, the grid is needed to guide teachers in:
   a. choose KD that can be made HOTS questions
   b. formulating Competency Achievement Indicators (GPA)
   c. choose the main material related to KD to be tested

d. formulating question indicators
e. determine cognitive level
f. Determine the form of the question and the number of the question

3. **Choose an interesting and contextual stimulus**
   The stimulus used should be interesting, meaning that it encourages students to read the stimulus. Interesting stimuli are generally new, have never been read by students. While contextual stimulus means a stimulus that is in accordance with the reality in everyday life, is interesting, encourages students to read. In the context of the School Examination, the teacher can choose a stimulus from the school environment or the local area.
4. **Write question items according to the question grid**
   The questions are written in accordance with the rules for writing HOTS items. The rules for writing HOTS items are somewhat different from the rules for writing items in general. The difference lies in the material aspect, while the construction and language aspects are relatively the same. Each question item is written on a question card, according to the attached format.
5. **Create scoring guidelines (rubrics) or answer keys**
   Each HOTS item written should be accompanied by a scoring guide or answer key. Scoring guidelines are made for the form of description questions. While the answer keys are made for the form of multiple choice questions, complex multiple choice (true/false, yes/no), and short entries.

2.2 The Nature of Critical Thinking Ability

The ability to think critically is one of the assets that students must have as a provision in facing the development of science and technology at this time. Critical thinking skills and problem solving are considered as fundamental skills in 21st century learning. According to Liberna(Ridho et al., 2019)Critical thinking ability is the ability to solve problems that are very important in everyday life through serious, active, thorough thinking in analyzing all information received by including rational reasons so that the appropriate action is taken. While Mason (2010: 25) the concept of critical thinking can be one of the most important trends in education which is dynamically related between how teachers teach and how students learn (The concept of critical thinking may be one of the most significant trends in education relative to the dynamic relationship between how teachers teach and now students learn).

According to Ennis (Ridho et al., 2019)Critical thinking is thinking in a rational and reflective way so that you can decide what to do and believe. While Brookhart(Arifin, 2018) Critical thinking is a form of thinking that includes reasoning, questioning, investigating, observing, comparing, connecting, and finding points of view.

Based on the theoretical explanation above, it can be concluded that critical thinking ability is the ability to think in a systematic analysis, make decisions reflectively, be able to distinguish problems carefully and thoroughly, and identify and review information in order to plan problem solving strategies.

Indicators of critical thinking ability according to RH Ennis (Ridho et al., 2019) that is :

a. Provide basic explanation
b. Building basic skills
c. Conclude
d. Make further explanation
e. Strategy and tactics

According to Anderson (Fachruraz, 2011: 12) indicators of critical thinking skills are:

a. Interpretation contains categorization, coding (making the meaning of sentences), classifying meaning
b. Analysis consists of testing and examining ideas, identifying arguments, analyzing arguments
c. Evaluation consists of evaluating and considering the client/statement, evaluating and considering arguments
d. Drawing conclusions includes doubting facts or data, making various alternative conjectures, explaining conclusions
e. Explanation consists of writing down results, considering procedures, presenting arguments
f. Independence consists of conducting independent testing and self-correction.

While the indicators of critical thinking according to Edward Glaser in Alec Fisher (2009: 7) are:

a. Recognizing the problem
b. Looking for ways that can be used to deal with these problems
c. Collecting data and compiling the necessary information
d. Recognizing unstated assumptions and values
e. Understand and use language appropriately, clearly and specifically
f. Analyze data
g. Assessing facts and evaluating statements
h. Recognizing the existence of a logical relationship between problems

Based on the explanation above, the indicator to be studied in critical thinking skills is the theory of RH Ennis which is used in the questionnaire instrument distributed to students. Clearly the guidelines for scoring critical thinking are presented in table 4

Table 4. Critical Thinking Ability Indicator

Indicator Critical thinking	Critical Thinking Sub Indicator
1. Provide basic explanation	- Focusing the question - Analyze arguments - Ask and answer clarifying and challenging questions
2. Building basic skills	- Consider whether the source is trustworthy or not - Observing and considering the results of observations
3. Conclude	- Deducing and considering deductions - Induce and consider the results of induction - Creating and reviewing the values of the consideration
4. Make further explanation	- Define terms and consider definitions - Identify assumptions
5. Strategy and tactics	- Deciding on an action - Interact with other people

2.3 Economics Learning Materials

Economics subjects in high school (SMA) are subjects that discuss human behavior and actions to meet the many, varied, and growing needs of life with existing resources through choices of production, consumption, and or distribution activities. Economics subjects are given with the aim of equipping students with a number of economic concepts to know and have the following abilities:

1. Grateful for the gift of God Almighty for the abundance of resources in the context of fulfilling the needs of human life and relationships with the social and natural environment.
2. Understanding economic concepts to relate economic events and problems with everyday life, especially those that occur in the individual, household, community and state environment.
3. Show an attitude of curiosity towards a number of economic concepts needed to study economics.
4. Develop behavior (honest, disciplined, responsible, caring, polite, environmentally friendly, mutual cooperation, cooperation, peace-loving, responsive and proactive) and form a wise, rational and responsible attitude by using knowledge and skills in economics, management, and accounting that are beneficial to the community. self, household, community and country.
5. Making responsible decisions based on socio-economic values in a pluralistic society, both on a national and international scale.

The economics subject matter at Sultan Iskandar Muda Private High School, Medan for class XI IPS for the 2020/2021 academic year is in accordance with the even semester economics subject matter in the 2013 curriculum economics syllabus in accordance with the basic competencies, namely:

1.6 Analyzing APBN and APBD in economic development.
1.7 Analyzing taxation in economic development.
1.8 Describe international economic cooperation.
1.9 Analyzing international trade concepts and policies

III. Research Methods

This research is a development research that refers to the type of Research and Development (R&D) research using the Borg and Gall development model. The research was conducted at Sultan Iskandar Muda High School, Medan. This research was conducted in the even semester of the 2020/2021 academic year. The subjects in this study were students of class XI IPS at Sultan Iskandar Muda High School, Medan. While the object of this research is the teacher and the team of validity experts, namely material experts and evaluation experts. The instrument for assessing higher order thinking skills in this study used economics questions for class XI IPS SMA on Bloom's Taxonomy of types C4, C5, and C6. The instrument in this study contains different questions with the same level of difficulty. Problems are given in the form of multiple choice and descriptions to be completed for each level. The instruments in this study were in the form of validation sheets and tests. The assessment instrument in this study was the HOTS assessment instrument which was used at the development and testing stages. The development of the HOTS assessment instrument was carried out independently by the researcher and then theoretically validated by 2 expert validators, namely material and evaluation experts. Student response responses at the development stage were analyzed for empirical validity which included the validity of the test items, reliability, level of difficulty, discriminatory power, and data analysis of the results of

higher-order thinking skills. The analysis of quantitative data in this study is divided into four, namely the feasibility test of the assessment instrument, the HOTS characteristic test, the prerequisite test for data analysis, and the effectiveness test/hypothesis test. Qualitative data analysis was carried out through the results of the questionnaire, namely a review analysis to determine the feasibility of the content validity of the test instrument. This data includes qualitative data in the form of criticism, suggestions, and responses from the validators analyzed descriptively regarding the feasibility of the resulting product.

IV. Result and Discussion

The development of an assessment instrument based on higher order thinking skills (HOTS) to measure students' critical thinking has been developed following the development steps of Borg and Gall. This instrument has been developed starting from the needs analysis stage, designing and designing grids and questions, product validation, product trials and revisions so as to produce a product, namely an assessment instrument based on higher order thinking skills (HOTS) which is then applied to measure critical thinking skills. student. The test instrument developed includes a multiple choice test with 20 questions and a description test with 5 questions.

The assessment instrument based on higher order thinking skills (HOTS) in the second semester of economics class XI IPS developed has been revised twice. The first revision received some input from supervisors at the development stage, in the second revision received input and suggestions from material expert validation lecturers and evaluation expert validation lecturers related to the product being developed. Then the product developed is improved according to the suggestions so that the product can be continued to the next stage.

For the results of the multiple-choice test instrument validation from the evaluation expert with an average score of 88 percent, it means that the instrument is in the very good assessment category and for the description test an average of 87 percent is in the very good category. Meanwhile, material experts for multiple choice test instruments and essay tests with an average of 84 percent are in the very good category. In the small field test stage, the assessment instrument is given to students and economics teachers to meet the feasibility of the next test instrument. From the results of student questionnaires, the results of the assessment of the multiple choice test instrument and the average description are 91 percent in the very good category, while the results of the questionnaire assessment instrument from the economics subject teacher are 88 percent in the very good category.

Before the large field test development process is carried out, an analysis of the quality of the test instrument has been determined to see the extent to which the resulting product is successful. For multiple choice test instruments and description tests, it has been determined that they must be valid and reliable, have a level of difficulty, and distinguish between questions. Based on the results of a large field test with a sample of 30 people, it was found that the multiple-choice test instrument as many as 20 questions were in the valid category with a question reliability level of 0.89 in the very high category, for the difficulty level of the multiple choice test all were in the medium category and for power The differentiating questions are in categories, namely 8 questions in the very good category, 7 questions in the good category, and 5 questions in the sufficient category.

Thus, the assessment instrument based on higher order thinking skills (HOTS) as the final product resulted in a multiple choice test instrument of 20 questions and a description test of 5 questions. This is in line with the opinion of Arikunto (2014) that the instrument or measuring instrument used in the study must have been tested for validity and reliability and the validity coefficient is in the moderate to very good category.

After the product of the higher order thinking skills (HOTS)-based assessment instrument has gone through the stages of development, the final product of this research has provided a good and quality assessment instrument based on higher order thinking skills (HOTS) in economics subjects which is then carried out experimental research to see the effectiveness and measure the critical thinking ability of students of class XI IPS Sultan Iskandar Muda Private High School, Medan. For the student's critical thinking ability questionnaire, validity and reliability tests have been carried out first and all critical thinking instruments as many as 20 items are declared valid with a reliability level of 0.87 in the very high category.

To test the effectiveness of the product that has been developed, a pretest was first conducted on the sample, namely the experimental class and the control class. The pretest results for the experimental class have an average value of 49, the lowest value is 33 and the highest value is 70. Meanwhile, the control class has an average value of 43, the lowest value is 23 and the highest score is 65. It can be concluded that the experimental class and control class from the results of the pretest were not much different between the two sample groups.

From the posttest results, it was found that the application of an assessment instrument product based on higher order thinking skills (HOTS) to measure students' critical thinking skills with the results that 7.5 percent of students were in the good category in critical thinking skills, 70 percent of students were in the sufficient category in critical thinking skills. and 22.5 percent of students are in the low category in critical thinking skills. The average result of students' critical thinking skills is in the sufficient category, namely 66 percent. This is in line with Widya's research (2019), a higher order thinking skills (HOTS) assessment instrument to measure critical thinking skills, namely the average ability of students is in the sufficient category. In addition, research(Arifin, 2016) the higher order thinking skills (HOTS) instrument measures students' critical thinking skills that are still in the poor category, namely the average test result is 26.38 on a scale of 100.

From the results of the questionnaire distributed to experimental class students using the HOTS-based assessment instrument, it was found that 5 percent of students were in the critical thinking category, 60 percent of students were in the moderately critical category and 35 percent of students were in the uncritical thinking category, while the average student's ability are in the fairly critical category, namely 68.8 percent. This shows that the instrument developed is effective in measuring students' critical thinking skills and is in line with the results of the questionnaire obtained from the results of the distribution of students.

From the results of the research above, it can be concluded that the average ability of students to answer the assessment instrument based on higher order thinking skills (HOTS) to measure students' critical thinking skills is still in the sufficient category. Therefore, the importance of a higher order thinking skills (HOTS)-oriented learning process is carried out in order to train and hone students' abilities so that they are more accustomed to solving HOTS questions. This is supported by research(Hasan et al., 2020) to develop and optimize critical thinking skills so that students are accustomed to working on questions that hone critical thinking skills, not just teaching memorization and understanding concepts.

V. Conclusion

Based on the discussion of the research results that have been stated previously, it can be concluded:

1. The process of developing an assessment instrument based on Higher Order Thinking Skills (HOTS) in economics class XI social studies at Sultan Iskandar Muda Private High School, Medan through the Borg and Gall development stages, namely the needs analysis stage, designing and designing grids and questions, product validation, product trials and revisions to produce a product, namely an assessment instrument based on Higher Order Thinking Skills (HOTS) which includes a multiple choice test of 20 questions and a description test of 5 questions.
2. The feasibility level of the Higher Order Thinking Skills (HOTS) based assessment instrument based on the results of the study shows:
   a. The evaluation expert validation on the results of the multiple-choice test instrument had an average score of 88 percent, meaning that the instrument was in the very good category of assessment and for the description test an average of 87 percent was in the very good category. And the material expert validation of multiple choice test instruments and description tests with an average of 84 percent is in the very good category.
   b. The results of the teacher's questionnaire on the assessment instrument based on the Higher Order Thinking Skills (HOTS) obtained an average result of 88 percent in the very good category. Meanwhile, the results of the questionnaire on student responses to the Higher Order Thinking Skills (HOTS)-based assessment instrument obtained an average result of 91 percent with a very good category.
   b. The assessment instrument based on Higher Order Thinking Skills (HOTS) is considered effective in measuring critical thinking skills with the results of the acquisition of the average critical thinking ability of students in the sufficient category, namely 66 percent. And the results of the students' critical thinking questionnaire results on average students' abilities are in the fairly critical category, namely 68.8 percent.

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