

## The Ability to Understand Questions of Writing Scientific Works based on Higher Order Thinking Skill (HOTS) in SMAN 3 Medan

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**Abstract** : This study discusses about the ability to understand questions of writing scientific based on higher order thinking skill (HOTS) in SMAN 3 Medan. This type of research uses research and development in the field of education known as Research and Development (R & D). The location of this research is at SMAN 3 Medan. The research is conducted in the 2018/2019 Learning Year. The subjects in this study are 30 students of Class X of SMAN 3 Medan. The result shows that the ability to understand the assessment instrument questions of writing scientific work based on higher order thinking, students get an average value of 71 with sufficient categories.

**Keywords** : question; writing; scientific works; higher order thinking (HOTS); SMAN 3 Medan

### I. Introduction

The material that must be mastered by students in the 2013 class XI curriculum is learning to write scientific works that aim to explore and develop the basic competencies of students related to scientific work, as well as train students' skills which in the end they are expected to be able to make or write quality scientific work.

Writing scientific papers aims to publish a science to the public or other people, one forum that is often used as a place for that purpose is discussion. In that forum various things about scientific work were discussed together. Through this forum we can also obtain important information from a scientific work openly; accompanied by various information and responses as a complement to the discussion participants.

Recognizing the importance of learning to write scientific work for students, the study needs serious attention. Reality in the field, namely at SMAN 3 Medan, shows that learning to write scientific work is still experiencing problems and tends to be avoided by students. This is caused by the lack of understanding of values and other benefits that can be obtained by students when writing scientific work. In addition, the techniques used in learning to write scientific works are still lacking so that students' interests and competencies in writing scientific papers are also inadequate.

Another obstacle is that teachers are only guided by assessment instruments that are only provided by the government, so that the assessment instruments are not optimal. In addition, the teacher also conducts assessments only looking at the abilities of each student after taking a test or test. In addition, the preparation of questions is not in accordance with the indicators in the competency standard (SK) and basic competencies that must be achieved by students. It is recommended that the test to be tested must be in accordance with the standards of competence and basic competencies in order to achieve learning indicators. After that, the teacher carries out the assessment weights that have been determined in advance in the learning implementation plan (RPP).

In the development of assessment instruments the teacher must make regularity of the questions in accordance with the question grid. in high school 3 Medan the problem grid is

only in the form of essays while the test or test is done not only essays but also multiple choices. The previously created grid should be in the form of multiple choice and essays.

The development of assessment instruments based on Higher Order Thinking Skill (HOTS) in scientific writing material is expected that students are able to think higher because in writing scientific works students are required to think creatively to write perfect scientific works. Students are able to achieve the basic competencies that exist in learning to write scientific works carried out in the learning process and can measure students' abilities. The accuracy of the teacher in choosing and using assessment instruments used in the material for writing scientific works greatly influences the learning process, but in this case the teacher is still inaccurate.

The results of the analysis show that the instruments in the student book are inadequate because each task has only 3 to 5 questions. The instruments used in cognitive assessment in the form of questions that tend to test more aspects of memory, while the questions that train students' high-level thinking skills are not widely available, so it is necessary to develop a high-level thinking assessment instrument. Thus, the instrument of high-level thinking that is developed will help students exercise the ability to reason, analyze and express their opinions.

## **II. Review of Literature**

### **2.1 Assessment Instrument**

According to Minister of Education and Culture No. 104 of 2014 the instrument is a tool that meets academic requirements, so that it can be used for measuring instruments to measure a measuring object or collect data about a variable. Whereas, assessment instruments are tools used to assess learners' learning outcomes, for example tests and attitude scales. Another definition explained by Arikunto (2011: 25) is an instrument that can be used to facilitate a person to carry out tasks or achieve goals more effectively and efficiently.

Assessment is an activity that cannot be separated in the current education system. Improving the quality of education can be assessed from the values obtained by students. Of course, a good and unusual assessment system is needed. A good assessment system will be able to provide an overview of the quality of learning so that in turn it will be able to help teachers plan learning strategies.

Arikunto (2011: 25) defines assessment as an activity of collecting data to measure the extent to which a goal has been achieved. With such meaning, the arrow comes from the evaluation to the destination. Arifin (2012: 7) states that "teachers often conduct assessments to provide a variety of information on an ongoing and comprehensive basis about the process and results achieved by students". That is, the assessment is not only aimed at mastering one particular field, but it is comprehensive which covers aspects of knowledge.

Asmin & Abil (2017: 3) say that the assessment is interpreted as a form of application and varied methods and the application of various assessment instruments to obtain information about the extent of student learning outcomes or the achievement of student learning competencies. Meanwhile Rasyid and Mansur (2017: 7) Explain the meaning of assessment is all activities carried out by teachers and students to assess themselves, which provides information to be used as feedback to modify learning and teaching activities.

Mangiante (2013: 222) entitled "Planning Instruction for Critical Thinking: Two Urban Elementary Teachers' Responses to a State Science Assessment" Vol.3, No.3 explaining assessment is a tool to measure the extent to which students have improved their learning based on standards .

In line with Abosalem (2016: 3) entitled "Assessment Techniques and Student Higher-Order Thinking Skills" Vol. 4, No.1 says assessment is the collection of information to make evaluative decisions and used in relation to the test.

Based on RI Government Regulation No. 32 of 2013 concerning the assessment standard explained that assessment is the process of gathering and processing information to determine the learning outcomes of students. This is in line with Kunandar's opinion (2014: 66) saying that assessment is a series of activities to obtain, analyze, interpret data about the process and learning outcomes of students conducted systematically, accurately and continuously by using certain measurement tools, such as questions and observation sheets, so that it becomes meaningful information in making decisions related to the achievement of student competencies. This is reinforced by Asrul's opinion (2015: 2) saying that, assessment is a systematic or continuous process or activity to gather information about the process and learning outcomes of students in order to make decisions based on certain criteria and considerations.

Nurgiyantoro (2010: 89) says the assessment instrument is a tool used to obtain information about students, both test and non-test. Nufus (2017: 2) says that, a good assessment instrument contains questions that accurately investigate whether students understand and apply lesson concepts accompanied by attitudes like a scientist.

The instrument of this study uses instruments in the form of tests. Test assessment instruments require a teacher to make a question. The questions made must be based on the grid that was made before. This study will develop assessment instruments in the form of objective tests (multiple choice, match test, correct test) and will also develop assessment instruments in the form of subjective tests (descriptions).

## **2.2 Test Assessment Techniques**

Written test is a set of items and questions or statements that the teacher plans systematically to obtain information about students. This test cannot be used affectively to evaluate students' psychomotor skills. However, it can be used to evaluate the principles that accompany skills including cognitive and psychomotor skills.

Kasueri (2014: 70) states that, a written test is a set of questions or assignments in the form of writing planned to obtain information about the abilities of test takers. Written tests require the answers of test takers as a representation of their abilities. There are several forms of test assessment techniques.

In line with the opinion of Arifin (2012: 130) says that the test is a technique or method used in order to carry out measurement activities, in which there are various questions or a series of tasks that must be done or answered by students to measure aspects of student behavior.

The following will be presented in several test screening techniques. Djiwandono (2011: 36) states that, the type of scoring test can be done in the following ways:

### **a. Objective Test**

The form of objective tests is also called a short answer test. As the name implies, a short answer test requires students only by giving a short answer, even just by selecting certain codes that represent the alternative answers provided, for example by giving a cross, circling or blackening the answer options that are definite, correct student answers a question item will be correct by the corrector.

Djiwandono (2011:36) says that objective tests are tests whose scoring can be done with a high level of objectivity. Objectivity tests can be put in the form of matchmaking tests, incorrect tests and multiple choice tests.

1) Matching Test

Matching tests assign assignments to test participants to match arranged in the form of two rows of test items. The first row consists of questions, questions or the initial part of a statement or just loose words. Each statement in the first part is numbered, for example 1 to 10. The second row, which is located to the right of the first row, consists of answers to the questions or the end of a statement. Each part of the second row is marked differently by the mark used in the first row, for example letters a to j.

2) The test is incorrect

The true test consists of a number of test items, each in the form of a statement. Some of the statements are true in the sense that they are supposed to be, some others are in the form of wrong statements, which are not in accordance with or contrary to what they should be.

3) Multiple Choice Tests

The discussion of multiple choice tests includes basic features, the advantages of multiple choice tests. The main characteristics of a multiple choice test are a type of objective test, each of which has more than two answers. One multiple choice test consists of the appropriate statement or the choice of the correct answer. The number of choices commonly used, each choice is marked (a), (b), (c) and (d). Of all the choices, only one is really the right answer, often called the key answer. Other choices are incorrect answers compared to the correct correct answers. Choices outside the correct answer are called deceptive (Djiwandono, 2011: 41).

b. Subjective Test

Kasueri (2014: 90) says that, the written test of the description form is a test whose answer requires students to remember and organize ideas or things that have been learned. This is in line with the opinion of Djiwandono (2011: 56) explaining that, the test is categorized as a subjective test if the scoring of the test participant's work is impossible to do objectively and can only be done subjectively.

The statements and assignments given in the test are formulated in such a way as to invite answers and the implementation of various test assignments, content, wording, and the short length of the answer. Such answers can only be scored according to the opinion and subjective judgment of a corrector. Implementation of subjective tests in general, questions can be arranged in the form of essay tests, tests with questions using question words, tests with short answer questions, tests complete.

1) Essay Test

More specifically, essay tests refer to tests whose answers are in the form of an essay or description in various writing styles. Such as descriptive and argumentation, in accordance with the problems that are the subject of a short discussion of the answers outlined in the form of essays depending on the signs of workmanship, which are generally set out in the form of instructions on how to do the test.

2) Test questions using question words

Subjective tests of this type consist of test items which are formulated in the form of question sentences beginning with a question word.

3) Test with short answer questions

The test with this pende question consists of test items, each of which is a question that formulates using question words. The answers to these types of questions are expected to be given briefly and shortly, without wording and praising in full and complete sentences.

#### 4) Complete tests

### **2.3 Higher Order Thinking Skills (HOTS)**

Higher order thinking skills or Higher Order Thinking Skills are students' thinking patterns by relying on the ability to analyze, create, and evaluate all aspects and problems. The main purpose of Higher Order Thinking Skills is how to increase the ability to think of students at a higher level, especially those related to the ability to think critically in receiving various types of information that come to him, think creatively in solving problems with the knowledge he has and make decisions in complex situation.

Saputra (2016: 92) says that, high-level thinking is an increase in students' ability to understand and master learning materials so that he can think critically (critical thinking), creative (creative thinking), able to solve problems (problem solving) and be able to make decisions (making decision) in difficult situations. Thus high-level thinking skills (Higher Order Thinking Skill) include the ability to write scientific work in analyzing, evaluating and creating.

The ability of high-level thinking broadly uses thoughts that can interpret, analyze, manipulate information that answers questions, problems that must be solved. Saputra (2016: 91) states that HOTS is a process of thinking students in a higher cognitive level developed from various concepts and methods and taxonomies of learning.

Kusuma (2017: 26-32) entitled "The Development of Higher Order Thinking Skills (Hots) in the Instrument Assessment In Physies Study" Vol. 7, No.1 states that high-level thinking is a higher order. challenge. Higher order thinking demands that someone has a new information or knowledge that has got the information to reach the possibility of answer in the new situation. The above definition explains that high-level thinking uses thinking widely to find new challenges. High-level thinking requires someone to apply new information or knowledge that he gets and manipulate information to achieve possible answers in new situations.

Agustya ningrum's research (2015: 39-46) entitled "Developing Higher Level Thinking Skills in Middle School Mathematics Learning" Vol. 4, No. 1 states that high-level thinking is a Higher order thinking that takes place and information and information is stored in memory and interrelated and distributed and extends this information to achieve a variety of situations. The definition above explains that high-level thinking skills will occur when someone associates new information with information that has been stored in his memory and connects it and rearranges and develops that information to achieve a goal or find a solution from a situation that is difficult to solve.

### **2.4 Writing Scientific Work**

According to Tarigan (2009: 21-22) writing is to reduce or describe the symbol of a graph that describes a language that is understood by someone so that other people can read graphic symbols. Another definition of writing is proposed by Dalman (2012: 1-2) saying writing can be defined as an activity of delivering messages using written language as a tool or medium. The definition of further writing was put forward by Hartono and Subyantoro (1999: 4) who argued that writing is placing or regulating graphic symbols that express an understanding of a



language in such a way that other people can read the graphic symbol as part of presenting units of language expression.

The opinion above is reinforced by the notion of writing put forward by Mulyati, et al (2005: 233) stating that writing is essentially conveying ideas / ideas and messages using graphic symbols (writing). Wiyanto (2006: 1-3) defines writing into two meanings. First, writing means changing the sound that can be heard into visible signs. Changeable sounds are called language sounds, namely sounds produced by human utterances. Second, the word writing means the activity of expressing ideas in writing. Writing is an activity carried out by someone to produce a writing. Another definition expressed by Dewanto, et al (2007: 4) writing is the activity of creating a work in the form of writing that is never the same between one person and another. From the opinion above, it can be concluded that writing is an activity of expressing ideas, ideas, and feelings that exist in the mind into agreed graphic symbols so that they can be understood which results of writing between one person and another are never the same.

### **III. Research Method**

This type of research uses research and development in the field of education known as Research and Development (R & D). The location of this research is at SMAN 3 Medan. The research is conducted in the 2018/2019 Learning Year. The subjects in this study are 30 students of Class X of SMAN 3 Medan, while the objects in this assessment are assessment instruments writing scientific works based on Higher Order Thinking Skill.

### **IV. Discussion**

Student learning outcomes are obtained by giving a trial test using an assessment instrument that has been developed with the aim to see the extent to which students' understanding of the material of writing high-level scientific works is improved by using the assessment instruments developed in this study. The trial was conducted in 1 class, namely class XI MIA 1, which amounted to 30 students by looking at the acquisition of learning outcomes in writing scientific papers.

- a. Description of the results of the validation analysis of the test instrument writing high-level scientific thinking

This validation test is based on the results of field trials involving students to answer the questions that have been given. The aim is to find out the suitability of items with the material that is measured. Students involved in the process of validating the contents of the test assessment instruments to measure high-level thinking skills include 30 students. Validation test results from activity 1 questions and activities 2 multiple choice and description can be seen in the attachment.

Based on the calculation shows that the multiple choice questions in activity 1 numbered 15 items and a description of 5 items, then in the multiple choice questions 2 activities consisted of 10 questions and a description of 5 items. Then it is stated that the overall multiple choice questions and descriptions are declared valid because of  $t\text{-hitung} > r\text{-tabel}$ .

- b. The description of the results of the reliability analysis of the test instruments writes high-level scientific thinking

This reliability test is based on the results of field trials involving class XI MIA 1 students of SMAN 3 Medan. Many students in the class are 30 students. Students are asked to complete the items in the first activity 15 questions of multiple choice and a description of 5 questions with a time of 2x45 minutes and a second activity which each has a multiple choice of 10 items and description 5 and given a time of 2x45 minutes. Based on the results of the student's work, the level of reliability of the test can be calculated. The level of multiple choice reliability in Activity 1 was stated to be reliable with KR 0.62 with a 'high' interpretation level while in Activity 2 multiple choice was stated to be reliable with KR 1.04 'very high'. Then for the level of reliability of description in activity 1 it is declared reliable with a value of 0.18 while in activity 2 it is declared reliable with a value of 0.38. This shows that the test instrument is said to be reliable so that based on the analysis, there is no revision of the instrument for assessing the test of high-level thinking ability according to reliability testing.

- c. The description of the results of the analysis of the difficulty level of the test instrument writing a high-level based scientific work

The items about the test instrument can be said to be good if the items in the test have difficulty in interval 0.31-0.70, which shows that the items are not too difficult and not too easy. The level of difficulty of the developed text instruments is also obtained from the results of student work on the test. The following results of the analysis of the level of difficulty of the instrument of high-level thinking ability test in activity 1 get the average score of difficulty 0.64 with the criteria of "moderate" then in activity 2 get the average value of difficulty 0.62 with the criteria "moderate".

- d. Description of the results of the analysis of the distinguishing tests based on high-level thinking

The items of the high-level thinking ability test instrument can be said to be good if the test items have the smallest differentiator is 0.20, this indicates that the items in the test have a sufficiently minimal distinguishing power, the distinguishing items of the test assessment instrument items developed obtained from the results of student work data in field trials. The results of the distinguishing instruments of assessment can be seen in the appendix.

- e. The data description results from the ability to understand the questions of writing high-level scientific thinking

Data analysis conducted on the learning outcomes of test instruments writing high-level scientific-based scientific work obtained an average score of 71.00% with the assessment criteria in the "sufficient" category, meaning that the students' achievement in writing scientific papers had not yet achieved the desired expectations but needed to be improved again. Can be seen in the following table 1.

**Table 1.** Data on the Results of the Ability to Understand Questions Writing Scientific Work Based on Higher Order Thinking Class XI Students of SMAN 3 Medan

No	Name	Activity 1	Activity 2	Assessment of Student Learning Outcomes
1	Alfithto Sandy. B.	69.5	77.5	73.5
2	Alfyyah Zahirah Hakim	82.5	82.5	82.5
3	Abedango Simarmata	87.5	92.5	90
4	Bagus Permana	80.5	70	75.25
5	Budi Utama	77.5	77.5	77.5
6	Cindy Wulan	80.5	67.5	74
7	Chairane	82	77.5	79.75
8	Chairunnisa	71	72.5	71.75
9	Fachrida Cailly	63.5	62.5	63
10	Grace Angela. S.	71	62.5	66.75
11	Ishamina Hashiliyah	61.5	55	58.25
12	Juwita Asmara	64.5	50	57.25
13	M. Azhar Ditia. S.	77	80	78.5
14	M. Rifqi Adrian	73.5	72.5	73
15	Muhammad Raka Siregar	83.5	60	71.75
16	Mutiara Sani	68	75	71.5
17	Mora Karunia Nasution	85	65	75
18	Mas Guru	80.5	75	77.75
19	M. Arya Aziz	74.5	75	74.75
20	M. Fauzan Hafizaruli	77	80	78.5
21	M. Adriyan. A. Daulay	73	70	71.5
22	Meliani Sihombing	66	60	63
23	Nabila Hasanah	74.5	72.5	73.5
24	Nadia	85	82.5	83.75
25	Nadila Tri Viola	78.5	60	69.25
26	Putri Permata Sari	68.5	60	64.25
27	Rahil Farah Diba	66.5	65	65.75
28	Sabrina Soleha	56.5	82.5	69.5
29	Tiara Ramadhani Harahap	61.5	47.5	54.5
30	Wafiq Indana Zulva	54.5	47.5	51
<b>Total</b>				<b>2136</b>
<b>Average</b>				<b>71</b>

The frequency distribution of the test value of student learning outcomes of writing scientific based on higher order thinking can be seen in the following table 1.



**Table 2.** Distribution of Value Frequency of Test Results Instrument Test Writing Scientific Work Based on Higher Order Thinking

Answer	Frequency	Percentage
90-100	1	3%
80-89	2	6%
60-79	23	76%
40-59	4	13%
< 40	-	-
$\Sigma$	30	100

The table above shows that students who get 90-100 scores amount to 1 person or 3%, who get a value of 80-89 totaling 2 people or by 6%, which gets a value of 60-79 amounting to 23 people or equal to 76%, who get the value of 40-59 is 4 people or 13%. The total number of students is 30 people. After getting a lesson by using an assessment test instrument writing scientific works based on high-level thinking, student learning outcomes with an average score of 71.

Akker (1999: 10) states the practicality in development research that is "practically referring to the extent that user (or order expert) consider intervention as appealing and usable in normal conditioning". Practicality refers to the level that users consider interventions can be used and preferred under normal conditions. This means that the practicality of the product is easy and can be used by teachers and students. In each stage of the trial, each student will assess HOTS-based assessment instruments by filling in the student questionnaire in which there are 12 assessment indicators.

Research and development is carried out with the aim of producing a product in the form of a high-level based assessment instrument while at the same time testing the understanding of the questions on the product so that it can be used by class XI students of SMAN 3 Medan. Therefore, the assessment and development process is carried out and begins with several stages including (1) Conducting preliminary studies through observation and literature. From the results of observations obtained data that students really need assessment instruments. (2) Developing instruments. This activity includes introductory words, KI and KD, learning activities and bibliography. (3) Designing learning activities includes arranging lattices, question instructions, answer sheets, multiple choice questions and descriptions, answer keys, and scoring. (4) Conduct validation and revision, this activity includes product evaluation to find out the strengths and weaknesses of the quality of the content carried out by material experts and evaluation experts. The evaluation results will be used as material for product revisions. (5) Conducting individual trials, small group trials, and limited group / field trials so as to produce assessment instruments to write high-level scientific-based scientific work for class XI students of Medan SMN 3.

The results of the validation of the material experts and the development of the assessment instruments writing high-level scientific-based scientific work indicate that the material feasibility of the instrument, the content, the feasibility of presentation, and the language's validity are in the "good" criteria. Then, the results of the validation from the evaluation expert also address overall good results with the criteria of "good".

The results of the data obtained from the teacher stated that the research instruments in the form of high-thinking scientific writing writing instruments for class XI students were developed in accordance with the assessment of indicators in the overall statement with an

average of 84.16% with the criteria of "good". This is a response from the response or response given by an educator to his assessment of the instrument developed based on high-level thinking to be applied in the learning process.

In this study, the researchers conducted three stages of the trial, namely the stages of individual trials, small groups and the coa field test. The data were obtained from students that the assessment instruments in the form of writing instruments of high-level thinking-based scientific works were developed in accordance with the assessment of indicators in the overall statement showing that (1) the average percentage of individual trials was 77% in the "sufficient" category. (2) the average percentage of the small group trials is 83.66% with the category "good", (3) the average percentage of the limited group trials is obtained an average of 90.16% with the category "very good".

In the Field trial stage researchers also tested the level of ability understanding students to see the effectiveness of the assessment institution. Akker (1999: 10) states that "effectivity refers to the extent that the experiences and outcomes with the intended aims" Effectiveness refers to the level that the experience and results of the intervention are consistent with the intended purpose.

After testing, the students' understanding of the assessment instrument writing high-level scientific-based scientific work gets sufficient criteria, this can be seen from the final results of the assessment instrument with an average score of 71. Obstacles students get are enough because students still feel unfamiliar with the HOTS-based questions Because students generally only work on the questions contained in the textbook. Then students are not careful in working out the questions, then the students' mistakes in understanding the questions given and the inefficiencies in the execution of the questions. Students are less complete in reading social questions so that the workmanship of the problem becomes difficult to understand the questions of high-level thinking. Therefore this assessment instrument can be used by the teacher as a learning resource so students are required to think highly.

## V. Conclusion

The results of the ability to understand the assessment instrument questions of writing scientific work based on higher order thinking, students get an average value of 71 with sufficient categories. Thus it can be stated that the instrument of higher order thinking on students of SMAN 3 Medan with sufficient quality.

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