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Analysis of *Higher Order Thinking Skills Indicators on Physics* Student Worksheet Class XI Semester II

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ABSTRACT

One of the key contents of the implementation of the 2013 program is the application of learning-oriented learning to forge higher-order thinking skills. Observational results show that the student worksheet used in public high schools in Padang city is the student worksheet made by the teachers and the student worksheet released by the publisher. It is yet to be determined whether all student worksheet already contain the HOTS components required by the program. Therefore, a study on Component Analysis of Higher Order Thinking Skills (HOTS) was carried out during the student worksheet XI Semester II Physics Class at SMAN Padang City. This research is a descriptive research with a qualitative approach. The population is all worksheets for class XI senior high school physics students in semester II which are used by 16 public high schools in Padang City. The sample is student worksheet Physics SMA Class XI Semester II with the most 3 student worksheet. The research data used the student worksheet presentation analysis instrument and data collection techniques through documentation studies. Based on the analysis, it can be concluded that the Semester II Class XI Physics student worksheet used by SMAN in Padang City is of the low-facilitation and non-facilitation category. Search results for the HOTS component of student worksheet questions are in the least favorable category. The question sheets with the highest HOTS component are those with the RC-IP code student worksheet XI/II in the moderately supported category. While other student worksheet are of the low-facilitation and non-facilitation type

Keywords: *Analysis; Student Worksheet; High Order Thinking Skill (HOTS).*

I. INTRODUCTION

Education has an important role in preparing generations to face future challenges. Education is carried out to form logical thinking, develop intellectually, continue the values of ideas, and improve thinking skills so that they have logical, structural and systematic thinking [1] In Indonesia, the implementation of education refers to the 2013 program aimed at improving the quality of human resources and the country's competitiveness due to the rapid development of science, technology and languages [2]. The 2013 program is expected to create productive, creative and innovative human resources through attitude skills (mental and social), intellectual skills and competency skills in line with requirements. skills of the 21st century, one of which is higher order thinking. .

Higher order thinking skills (HOTS) are skills to solve complex problems systematically and accurately [3] HOTS are skills of critical thinking (analysis and evaluation), creativity (building construction, planning and production), problem solving, reasoning and decision-making abilities [4]. Higher order thinking skills feature complex, non-algorithmic characters, multiple alternatives, multiple interpretations, and full of meaning and impact [4]. Building and training higher-order thinking skills for students today is important because higher-order thinking skills are one of the mindsets that support students' lives not only in school but also in school. in everyday life.

According to a survey conducted by the Organization for Economic Cooperation and Development (OECD) using the Program for International Student Assessment (PISA) test in 2015, education in Indonesia was ranked 69th. out of 76 countries that passed the PISA test and Indonesia scored 403 in 2015, p. This shows how important it is for teachers to help their students think at a higher level to be able to compete with other countries. One of the factors behind low thinking skills is that Indonesian children are not trained to take tests or quizzes that require analysis, evaluation and creativity. Questions with these characteristics are HOTS questions. In addition, another reason is that students do not have available HOTS-based teaching materials that can train students' high-level thinking. In fact, higher order thinking capacity in Indonesia has not yet achieved the desired goal [5]. According to the results of the Program for International Student Assessment (PISA) 2018 organized by the Organization for Economic Cooperation and Development (OECD), Indonesia's scores are still below average13. The average score of Indonesian students in reading (OECD, 2018), is much lower than the OECD average of 487. For the average score in math, Indonesia's score is 379 while the average score of the world The average score in science was 487. After that, the average score of Indonesian students was 389 and the overall GPA was 489 [6]. This shows that very few Indonesian students have the ability to think at a high level in a subject, and also few students achieve a minimum level of proficiency in a subject [7]. The OECD refers to the need for Indonesia's efforts to improve the education system in Indonesia. Furthermore, studies have also shown that the HOTS level achieved by students in physics is not satisfactory [8].

This needs to be anticipated intelligently by practitioners in the field, not by simply helping students practice questions, but by providing them with application and reasoning skills (thinking at a higher level and looking at the data presented in various forms of presentation). Indonesian students' reading comprehension skills are lacking and need assistance, because many essay questions are not answered. Even if they respond, the response still shows low-level, linear, and fragmentary (not comprehensive) reasoning. One of the tools for students is teaching materials in the form of spreadsheets.

Physics subjects are closely related to higher-order thinking processes. Physics trains students in thinking complexly because it does not only require students to be able to solve problems mathematically, but students are required to be able to find their physical concepts [9]. Problems in physics are nothing but phenomena that occur in everyday life so that physics is one of the subjects that can help students to train higher-level thinking. The ability to think at a high level in students can be achieved if students continue to be trained in the learning process. In addition, teachers must be able to create learning conditions that build students' thinking skills [10]

Results of interviews conducted with a professor of physics at SMA 9 Padang, it is known that all students in their class have student worksheet, handbooks or textbooks only for the teacher's hand and not distributed to students, especially in the 2013 curriculum where most of the package books from the government have not been all at school. Similar information was also obtained from several students who had carried out Field Experience Practice (PPL) at a high school in the city of Padang, that during the learning process the teacher used the student worksheet a lot as a means to activate students, and the frequency of its use exceeded that of reference books. To hone and develop these Higher-Order thinking Skills, training is needed in solving real problems, carrying out investigative processes, and carrying out discussion processes which in learning activities can be carried out using learning models and assessment instruments for proper evaluation1[9] .

This needs to be intelligently anticipated by practitioners in the field, not simply by helping students ask questions but also by providing them with reasoning and application skills (level thinking). higher degrees and consider data presented in a variety of representations). Indonesian students' reading comprehension skills are lacking and need help as many essay questions remain unanswered. Even when they do, the answers still demonstrate low-level, linear, and partial (not exhaustive) reasoning. One of the tools for students is teaching materials in the form of spreadsheets. " Analysis Of Higher Order Thinking Skill Indicators In Physics student worksheet Class XI Semester II"

II. METHOD

This type of research is descriptive research with a qualitative approach. Descriptive research aims to describe a phenomenon or event in order to explain or describe things as they are. It is a qualitative approach that produces descriptive textual or verbal data of people and observed behaviors. [10]

The population of thissstudy included all SMA class XI physical student worksheet used by 16 public schools in the city of Padang. In this study, the authors sampled using a non-probability sampling technique, that is, sampling with purpose, that is, a technique of identifying samples based on certain considerations. With Porposive sampling technique, in this study, the author sampled 1 high school physics worksheet used mainly

by 16 schools in Padang city, namely student worksheet compiled by Risdiyani Chasanah et al. with publisher Intan Pariwara and year of publication. 2019 has been encrypted (IP).

The research tools used are compiled by themselves and their validity will be checked. In this study, a breakdown in the form of a statement was used. Each rating category is assigned a range from 0 to 1 for each indicator contained in the three HOTS components according to Bloom's Taxonomy Review (Anderson and Krathwohl 2001), namely: C4 (Analysis), C5 (Synthesis), C6 (Evaluation) on the subject matter of SMA Class XI Semester II. It will be given a value of 0 if the indicators on the HOTS component cannot be found in the LKS presentation and will be given a value of 1 if indicators can be found in the student worksheet book presentation.

Data collection techniques are methods used to collect research data or information. The data collection techniques in this study were performed through desk research, information gathered from a variety of textual sources or from the literature. This literature review is done by gathering documents or data needed for the research problem and then delving into them. The data obtained through the document method is the data on the use of the second semester physics worksheets in class XI in some schools related to the HOTS component. so the data obtained is that class XI physical student worksheet has the highest usage rate among 16 schools in Padang city

The data analysis technique used is content analysis, which is a method for making contextual inferences (conclusions) to fully understand media messages [11]. Content research is a procedure used to draw valid conclusions from a book or document [12]. Thus, data analysis with content assessment is a procedure used to draw conclusions from books or documents so that they can be understood as a whole..

Table 1. Criteria for serving class XI SMA Physics student worksheet in semester II which can facilitate KPS practice

Percentage Criteria	Category
80 – 100	Very facilitating (SM)
61- 80	Can facilitate (DM)
41 – 60	Enough to facilitate (CM)
21 – 40	Less facilitating (KM)
0 – 20	Not Facilitating (TM)

III. RESULTS AND DISCUSSION

Based on research done by analyzing 3 sample spreadsheets. Sample includes 1 student worksheet from Risdiyani Chasanah Intan Pariwara editor with RC-IP code, from Mandiri Intan Pariwara editor with M-IP and FK code. Analysis was performed to determine the availability of four HOTS indicators in the content presentation and HOTS-based assessment questions for each document in each student worksheet. The availability of the four HOTS indicators in the content presentation and the HOTS-based assessment questions on the worksheets is described as follows..

Table 2. Presentation of HOTS index data for all documents of Class XI Semester II student worksheet

Code LKS	Indicator HOTS	Material Code Materi (%) HT	GM	GBS	BC	AO	PG	Mean	Category
	PM	83.3	58.3	50	58.3	58.3	66.7	62.5	DM
LKS	PK	57.1	14.3	57.1	71.4	42.9	57.1	50.0	CM
XI/II	BK	44.4	44. 4	33.3	55.6	44.4	22.2	40.0	CM
RC-IP	BF	57.1	28.6	0	28.6	14.3	14.3	23.8	KM
	Mean	60.5	33.7	35.1	53.5	40.0	40.1	43.8	CM
	PM	0	0	0	0	0	58.3	9.7	TM
LKS	PK	0	0	0	0	0	0	0.0	TM
XI/II	BK	0	0	0	0	0	0	0.0	TM
M-IP	BF	0	8.3	0	0	0	0	1.4	TM
	Mean	0.0	2.1	0.0	0.0	0.0	14.6	2.8	TM

LKS XI/II FK	PM	33.3	33.3	66.7	66.7	25	58.3	47.2	CM
	PK	0	42.9	0	14.3	28.6	71.4	26.2	KM
	BK	33.3	33.3	33.3	33.3	33.3	44.4	35.2	KM
	BF	57.1	0	0	28.6	0	38.6	20.7	KM
	Mean	30.9	27.4	25.0	35.7	21.7	53.2	32.3	KM

Table 3 presents data regarding the availability of 4 HOTS indicators in each student worksheet. From the table, it can be seen that the percentage availability of HOTS metrics is different for each document in each sheet. From the table it can be seen that there are materials/KD that are not included in the HOTS index. The analysis results of the student worksheet presentation for the thermodynamic law document in the three student worksheet can be seen in Figure 1 .

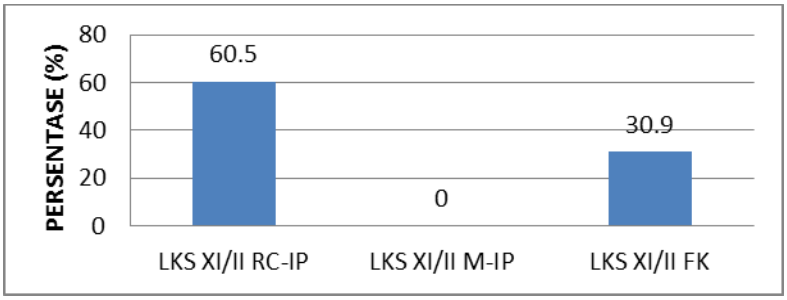

Figure 1. Average score ratio of the availability of HOTS indices in the law of thermodynamics

Based on figure 1 above, student worksheet XI/II CP-IP has an average percentage of 60.5% with the support capability category, student worksheet XI/II M-IP has an average percentage of 0 % in the unsupported category and student worksheet XI /II FK achieved an average percentage of 30.9% in the least favorable category. The most frequent HOTS index for the law of thermodynamics literature is in the student worksheet XI/II RC-IP with a 60.5% rate in the facilitated category. In the first HOTS indicator, specifically problem solving, the highest uptime is found in the student worksheet XI/II RC-IP with 83.3% in the very convenient category.

The results of student worksheet expression analysis for mechanical waves on student worksheet XI/II RC-IP, student worksheet XI/II M-IP and student worksheet XI/II FK can be viewed in Figure 2 below. category

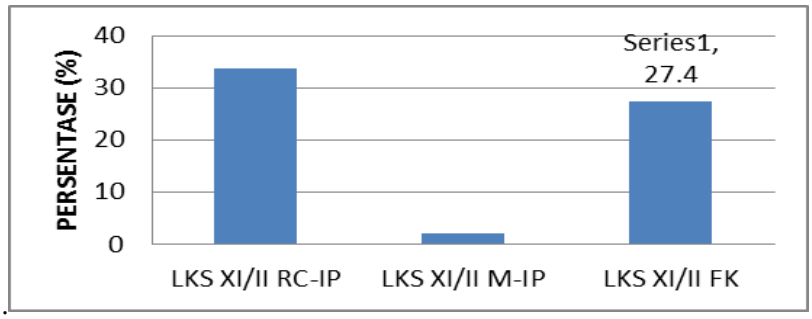

Figure 2. Average Uptime HOTS Score Percentage on Mechanical Wave Materials

Based on Figure 2, the average percentage is 33.7% with the least supportive category on student worksheet XI/II RC-IP, student worksheet XI/II M-IP has an average percentage of 2.1 % in the unsupported category and student worksheet XI/II FK achieved an average percentage of 27.4% in the least favorable category. The HOTS indicator that appears the most for mechanical wave material is on student worksheet XI/II RC-IP with a percentage of 33.7% with a fairly favorable category and the least appears on student worksheet XI/II M -IP with a percentage of 2.1% with the category category of non-facilitation.

The result of analyzing student worksheet presentation on this document is that there is one student worksheet with the average score of HOTS index availability in the unsupported category. For more details, see Figure 3 below:

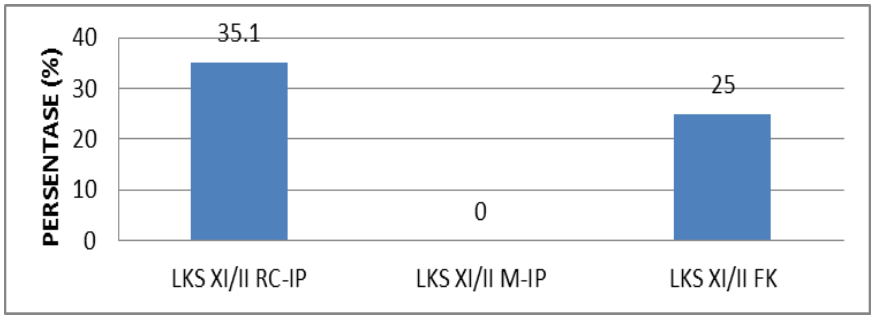

Figure 3. Average percentage availability of HOTS indicators in floating and fixed materials

Based on Figure 2 above, student worksheet F X/II RZ-GR obtained an average percentage of 35.1% in the less facilitating category, student worksheet XI/II M-IP obtained an average percentage of 0% in the non-facilitating category, student worksheet XI/II FK obtained an average percentage of 25% with the less facilitating category. The HOTS indicator that appears the most for running wave and stationary material is on student worksheet XI/II RC-IP with a percentage of 35.1% in the less facilitating category and the least appears in student worksheet XI/II M-IP with a percentage of 0% in the category not facilitating.

The analysis of the availability of HOTS indices in three spreadsheets for acoustic and light materials can be seen in Figure 4 below..

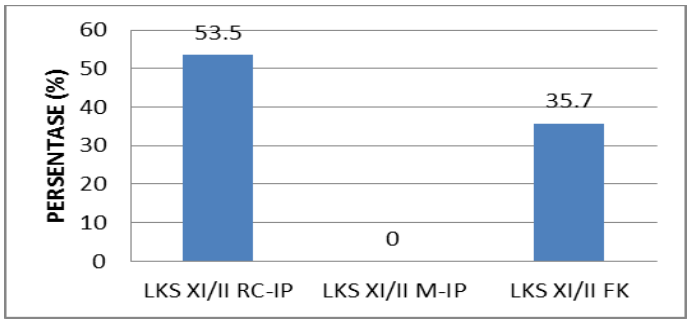

Figure 4. Percentage of Average Availability of HOTS Indicators in Sound and Light Material

Based on Figure 4 above, student worksheet XI/II RC-IP obtained an average percentage of 58.3% in the moderately facilitating category, student worksheet X//II M-IP obtained an average percentage of 0 in the non-facilitating category, and student worksheet XI/II FK obtained an average percentage of 35.72% in the less facilitating category. The HOTS indicator that appears the most for sound and light material is in student worksheet XI/II RC-IP with a percentage of 53.5% in the category of quite facilitating and the least appears in student worksheet XI/II M-IP with a percentage of 0% in the category not facilitate.

The analysis of the availability of HOTS indicators in the three worksheets for optical instruments can be seen in Figure 5 below.

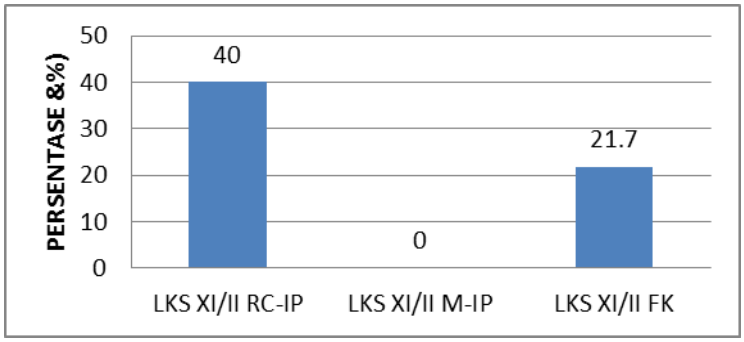

Figure 5. Average percentage of HOTS indicators in optical device materials

Based on Figure 5, student worksheet XI/II RC-IP obtained an average percentage of 40% in the less facilitating category, student worksheet XI/II M-IP obtained an average percentage of o% in the non-facilitating category, and student worksheet XI/II FK obtained a percentage an average of 21.7% with the less facilitating category. The HOTS indicator that appears the most for material on optical instruments is on student worksheet XI/II RC-IP with a percentage of 40% in the less facilitating category and the least appears on student worksheet XI/II M-IP with a percentage of o% in the category of not facilitating .

Thesults of the analysis of the availability of HOTS indicators in the three worksheets for global warming material and its impact on life can be seen in Figure 6 below.

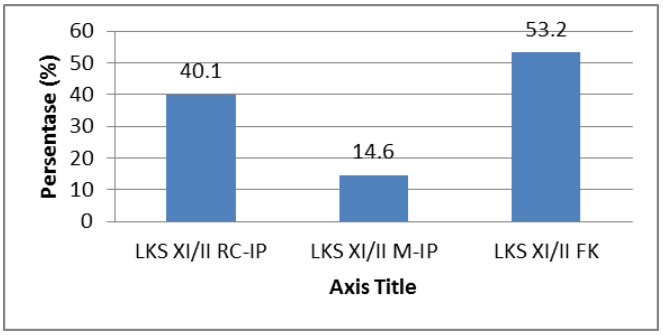

Figure 6. Average Percentage of Availability of HOTS Indicators on Global Warming Material and its impact on life

Based on Figure 6, student worksheet XI/II RC-IP obtained an average percentage of 40.1% in the category of not facilitating, student worksheet XI/II M-IP obtained an average percentage of 14.6% in the category of not facilitating, and student worksheet XI/ II FK obtained an average percentage of 53.2% in the quite facilitating category. The HOTS indicator that appears the most for optical instrument material is on student worksheet XI/II FK with a percentage of 53.2% in the moderately facilitating category and the least appears on student worksheet XI/II M-IP with a percentage of 0% in the non-facilitating category.

This researcher also conducted an analysis of the questions on the LKS starting from the level of LOTS questions, MOTS questions and HOTS questions. The presentation of data on the availability of the HOTS questions contained in the LKS can be seen in Table 10 below.

Table 2. Data Presentation on the Percentage of Availability of HOTS Questions in the LKS

Code LKS	Level Cognitif	Material Code (%)						Mean
		HT	GM	GBS	GBC	AO	PG	
LKS XI/II RC-IP	LOTS	6.7	20	10	23.3	10	100	28.3
	MOTS	90	73.3	83.3	70	63.3	0	63.3
	HOTS	3.3	6.7	6.7	6.7	26.7	0	8.4
LKS XI/II M-IP	LOTS	2.2	10	0	9.7	10	100	22.0
	MOTS	91.1	77.5	85	79.4	75	0	68.0
	HOTS	6.7	12.5	15	10.9	15	0	10.0
LKS XI/II FK	LOTS	0	15	5	20	20	100	26.7
	MOTS	85	60	80	60	73.3	0	59.7
	HOTS	15	25	15	20	6.7	0	13.6

Based on table 2 above, it can be concluded that the questions contained in the LKS mostly discuss MOST level questions. The three worksheets had a higher average MOST score than the HOTS questions. The HOST component contained in these three LKS is in the unavailable category and has a low percentage value.

Based on the results of the study, it can be concluded that class XI worksheets, namely worksheets XI/II RC-IP, worksheets XI/II M-IP and worksheets XI/II FIK show that in general they do not yet have the facility to train HOTS in class XI physics material. Therefore, physics teachers should use worksheets that are able to train HOTS on all physics material. It aims to improve critical thinking skills. This is in line with the opinion (Suci, Martini & Purmono 2021) which states that developing their own HOTS teaching materials and in implementing them in the classroom the teacher must help students to bring up HOTS. Supported by research (Pratiwi & Alimuddin, 2019) which states that not all of the existing textbooks from the center suit the needs of students in each region, developing teaching materials that contain higher-order thinking skills is one solution for teachers. The development of the textbooks themselves is not meant to replace textbooks from the center but rather to be a complement in the learning process, especially on Newton's Law material in the HOTS aspect. This is in line with research (Widodo et al., 2019) which claims that involving teachers as facilitators will make students active learning subjects in the learning process so as to enable them to develop higher-order thinking skills. Students can gain better knowledge of the problem by using effective learning tools, resulting in an increase in HOTS (Misrom et al, 2020).

IV CONCLUSION

The results of the study stated that the HOTS component in the presentation of the contents of the Physics student worksheet class XI semester II used by SMAN in Padang City was in the category of less facilitating and not facilitating. student worksheet that are categorized as less facilitating are student worksheet with the code student worksheet XI/II RC-IP and LKS XI/II FK. student worksheet which is not categorized as facilitating is student worksheet with code student worksheet XI/II M-IP. The results of the research on the HOTS component on the questions in the student worksheet are generally in the less facilitating category. Worksheets that have questions with the highest HOTS component are worksheets with code student worksheet XI/II RC-IP in the moderately facilitating category. While the other student worksheet are in the category of less facilitating and not facilitating.

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