

Design Analysis of Mathematics Teacher Lesson Plans Based on Higher Order Thinking

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Abstract- The quality of lesson plans are one of the factor determining success of the learning process in schools. One element of the 2013 curriculum transformation is 21st century skills, namely higher order thinking skills integration in mathematics learning. Basically, to get HOTS thoroughly mastered by the teacher, this later must be trained systematically starting from the planning stage. At the planning stage, the teacher is required to prepare a Learning Implementation Plan (RPP). This study aims to determine the results of analysis of class VIII mathematics lesson plans based on HOTS, and find out what obstacles experienced by mathematics teachers in the preparation of HOTS-based RPP. These problems were investigated through field studies conducted at junior high school (SMP) Negeri 1 Sukoharjo using the qualitative research approach that is survey research method. This study involved 2 grade VIII mathematics teachers. Data were obtained through various data collection techniques, including observation, structured and unstructured interviews, and documentation. Data were analyzed by phenomenology approach and descriptive analysis. Then the data are tested for validated through data triangulation. From the results of the analysis, there were 2 (two) answers to the problem statement. First, RPP is not fully based on HOTS, it could be seen in the selection of verbs in the preparation of indicators still at lower levels of order thinking skills. Secondly, the obstacles encountered by teachers in the preparation of lesson plans included the fact that HOTS- based 2013 curriculum training was only felt by some mathematics teachers, the distribution of books was too late, teachers felt that the understanding of HOTS was insufficient. They stated that compiling HOTS-based 2013 curriculum plans was not easy for them, the school only gives a syllabus. Through this research, it is hoped that all mathematics teachers in general and mathematics teachers at Sukoharjo Middle School 1 in particular can learn from the results of this HOTS-based lesson plan. So that in the future, teachers will be increasingly encouraged to improve their quality and improve the quality of education in Indonesia.

Keywords— higher order thinking skill, HOTS, mathematics teacher, lesson plan

I. INTRODUCTION

Indonesia's education vision in 2045 is to produce smart and skilled students. Curriculum 2013 is now starting to integrate PPK (Strengthening Character Education), 21st Century or 4C skills (Creative, Critical thinking, Communicative, and Collaborative), Literacy, and HOTS (Higher Order Thinking Skill). The 2013 curriculum must arrive at a contextual issues-based level of creation, so students must be continuously trained to think broadly to produce something new [1]. Students will be familiar with thinking critically and creatively both in decision making and problem solving related to analyzing, evaluating and creating [2].

The teacher is one of the stakeholders who has a crucial role in the process of forming students' HOTS [3]. Based on observations at Sukoharjo junior high School 1, the value of the National Examination in 2018 mathematics subjects declined. Due to the fact that the level of the problems' difficulty is raised by applying the question of Higher Order Thinking Skill (HOTS). from the 40 math questions tested, there were 4-5 questions that were categorized as "difficult" and demanded high analytical skills. The aim of the Ministry of Education and Culture is to increase the level of difficulty of the problem, which is expected that students' analytical power and critical thinking skills can be honed.

Before students are asked to solve HOTS questions, the teacher's ability to implement HOTS-based learning should be improved first. In fact, many teachers have not implemented HOTS-based learning activities. Basically, if the HOTS problem is to be fully and thoroughly mastered, then the teacher must be trained systematically starting from the planning, implementation, and how to assess student learning outcomes.

At the planning stage, the teacher is required to prepare a Learning Implementation Plan (RPP), where the teacher examines the Basic Competencies (KD) that are expected to be mastered by students, then formulates Competency Achievement Indicators (IKK) using Operational Verbs (KKO) which can be measured, mainly on cognitive aspects. By compiling the IKK, students' analytical-critical thinking skills will emerge and be honed, not just knowing or memorizing, but having higher abilities. The teacher must also design the appropriate model or method in learning to achieve the set IKK. In addition, the teacher also sets what learning media or teaching aids are used to help clarify the presentation of the subject matter. What are the learning resources used and what types and forms of assessment are carried out to measure the achievement of indicators. All these things are clearly illustrated in the RPP.

Based on the experience and information obtained by researchers, it shows that a number of teachers in schools lack preparation of learning tools such as syllabus and lesson plans when teaching. While the RPP they have only adopted RPP downloaded from the internet without looking at its suitability with the context of each class. From the results of previous studies stated that teachers do not have motivation because of the low knowledge of teachers in preparing lesson plans so that they only copy pastes from MGMP [4]. This results in the teaching carried out not planned carefully so that it influences the learning process. Other research also states that poor planning of teaching will result in a learning process that is not optimal [5]. As revealed by further research that in general the success of the implementation of learning carried out by a person is very much determined by the quality of the planning he made [6].

Based on the description above, this study seeks to contribute to education especially in the learning process of mathematics by conducting a study of the implementation of mathematics learning which is viewed from HOTS-based mathematics learning plans compiled by Grade VIII mathematics teachers at Sukoharjo Middle School 1 to be used as a platform for developing learning systems mathe-matics based on higher order thinking in the future.

II. METHODOLOGY

This research a qualitative descriptive research using the survey method. The survey method was chosen with the consideration that this study aims to obtain a description of the state of the population naturally and its nature. This study does not provide any treatment for the subject of research, but by giving a number of questions, observations and documentation in accordance with the actual situation. The main data in this study were in the form of answers and RPP observation results obtained from two eighth grade mathematics teachers at junior high school Negeri 1 Sukoharjo which showed how far the HOTS-based learning planning process was. Data collection techniques in this study were in the form of documentation, and interviews. The documentation record method is used to collect data in the form of syllabus, lesson plans, teacher books, student books, and document documents related to HOTS-based lesson plans. Interviews were conducted to obtain information about the challenges experienced by teachers in preparing HOTS-based lesson plans. The research instrument used was a HOTS-based RPP review sheet and interview guidelines. The lesson plan review sheet was used to determine the extent of the existence of HOTS in the lesson plan made by grade VIII mathematics teachers. This assessment was carried out using a Likert scale in accordance with the assessment indicators, which are then described qualitatively.

In processing data researchers used Likert's summated rating (likert) which is the method most widely used because of its simplicity [7]. The scale is as follows:

Very good	= 4, when the 3^{rd} indicator is achieved
good	= 3, when the 2^{nd} indicator is achieved
adequate	= 2, when the 1st indicator is achieved
less	= 1, when there is no indicator achieved

TABLE I.	TABLE OF	ASSESSMENT	DESIGN	INDICATOR	OF	HOTS
ORIENTED LESSO	ON PLAN					

Th	e observed aspects	Assessment Indicator						
А	the patterns of the	Clarity of indicators and objectives						
	indicator and the	Using KKO that can be measured						
	learning objectives	Searching the initial knowledge of the						
		students						
В	learning material	Conformity with learning objectives						
		Connecting the material with new relevant knowledge						
		Connecting the material with the daily reality of life.						
С	Selection of	Conformity with learning objectives						
	approaches /	Motivating active students						
	models	Fill with effective and meaningful questions						
D	learning activities	Conformity with learning objectives						
		Motivating active students						
		Fill with meaningful and effective questions						
Е	selection of	Conformity with learning objectives						
	learning resources	Using effective and efficient media						
	and learning media	Motivating active students						
F	learning	HOTS question type						
	assessment	Using opened questions						
		In the form of contextual problem						

Assessment category

 $\begin{array}{rcl} 1.1 - 1.5 & = \text{less category} \\ 1.6 - 2 & = \text{adequate category} \\ 2.1 - 3.5 & = \text{good category} \\ 3.6 - 4 & = \text{very good category} \end{array}$

III. RESULT AND DISCUSSION

HOTS learning can be achieved if it starts from a learning device that contains HOTS indicators as well. There is a significant relationship between the knowledge and abilities of teachers in compiling learning tools with classroom learning [8]. Permendikbud no. 22 of 2016 states that every educator in the education unit is obliged to prepare RPP in a complete and systematic manner so that learning takes place in an interactive, inspirational, fun, challenging, and efficient way [9]. Teacher readiness is needed to implement innovative forms of educational activities into the learning process [10]. The teacher must make a learning plan that is tailored to students, situations, their own insights, values and commitments [11]. Based on the research conducted obtained:

A. Result of Documentation

The results of the analysis carried out on the two teachers at SMP Negeri 1 Sukoharjo, it was found that one lesson plan contained 6 meetings for one chapter. There are 5 RPPs with the subject of number patterns, cartesian coordinates, relations and functions, straight line equations, and two-variable linear equation systems. From the review of the two teachers (A as Teacher 1 and B as Teacher B), it can be briefly presented in Table 2.

Based on the results of the lesson plan study review in table 1, teacher 1's ability to design HOTS-based RPPs is in the good category. The average achievement of indicator teacher 2 is 2 meaning that it is only categorized as sufficient. The teacher's shortcomings are seen in aspect A, that is, there are no visible indicators and learning objectives that direct students to high-level thinking skills. KKO used is still at LOTS level. Weaknesses are also seen in aspect B, which does not contain learning material that

can increase HOTS students, teachers only come from available textbooks and the material is not clearly written on the material.

TABLE II. RPP ANALYSIS RESULTS

Observed espects	RPP 1		RPP 2		RPP 3		RPP 4		RPP 5		Teacher
Observed aspects	A	В	A	В	A	В	A	В	A	B	Mean
Α	1	1	1	1	2	1	2	1	1	1	1,2
В	1	1	1	1	2	1	2	1	1	1	1,2
С	3	2	3	2	3	2	3	2	4	2	2,6
D	3	2	3	3	3	4	2	2	4	2	2,8
E	3	2	2	3	4	2	3	2	2	3	2,6
F	4	3	3	3	4	3	4	3	4	3	3,4
Mean	2,5	1,833	2,167	2,17	3	2,2	2,67	1,833	2,667	2	
Teacher mean 1								2,6			
Teacher mean 2							2				

Both teachers in aspect C always use scientific, contextual and cooperative learning approaches, these methods are methods that can improve students' high-level thinking skills because they can motivate active students to ask questions, respond to questions, express opinions, and conclude material. In aspect D, it can be seen to shape students' high-level thinking skills. Learning activities are divided into 3 parts, namely pre-liminary activities, core activities, and closing activities. The two preliminary activities of the teacher always begin by connecting learning material with contextual problems. Then the core activities include observing, asking questions, exploring, communicating, observing, and asking questions in accordance with the reference curriculum of the 2013 curriculum. The closing activity contains giving PR, concluding the material, and watching videos related to learning materials. In aspect F, the average score reaches 3.4, meaning that both teachers have applied HOTS questions in their assessment. This can be seen in the questions in the form of open questions, allowing students to have different alternative answers. Questions on 10 lesson plans require students to analyze, evaluate, and create.

B. Result of documentation

In the preparation of the mathematics lesson plan, the teacher only corrected the lesson plan used in the previous year. This is because the two teachers feel that the previous RPP is almost the same as the current year, so the teacher only needs to change in accordance with the latest rules in the preparation of the 2013 curriculum RPP. such as the background and level of thinking of students, because an IKK for certain students may include HOTS, but for other students it is considered LOTS (Lower Order Thinking Skills). Teachers who take part in the training already know that 2013 Curriculum requires students to be active. Yet to realize active students requires a learning model that can make students active. The second teacher only participated in the 2013 Curriculum training and lesson plan preparation, but for HOTS-based learning training had never attended training, but already knew how HOTSbased learning was. After the researchers asked about HOTS-based mathematics learning, the teacher answered that they only occasionally used HOTS-based questions, media and learning models. Not every meeting uses

HOTS-based mathematics learning, the reason is lack of time and students who are not patterned to think highlevel or think for themselves are still principled in receiving what is given by the teacher. When the learning process in the question class used is a question in the form of HOTS or contains an analyzing indicator (C4), evaluating (C5) and creating (C6), but not all students can answer there are only a few students who are able to solve the problem. So the questions given in the class must be easy, medium and difficult.

C. Discussion

HOTS learning can be achieved if starting from a learning device that contains HOTS indicators as well. There is a significant relationship between the knowledge and abilities of teachers in compiling learning tools with classroom learning [12]. Permendikbud no. 22 of 2016 states that every educator in the education unit is obliged to prepare a lesson plan in a complete and systematic manner so that learning takes place in an interactive, inspirational, fun, challenging, and efficient way [13]. Teacher readiness is needed to implement innovative forms of educational activities into the learning process [14]. The teacher must make a learning plan that is tailored to the student, the situation, his own insights, values and commitments [15].

In this study, the researcher collected RPP prepared by mathematics study teachers and then looked at the extent of the HOTS in the RPP. The existence of HOTS from RPP that has been analyzed is obtained from 3 out of 10 lesson plans only in sufficient category, while 7 others in good category. That is, the teacher still does not fully understand how to prepare HOTS-based lesson plans. In the selection of operational verbs for indicators of achievement of competencies and learning objectives are still at level L.

IV. CONCLUSION

Based on data obtained from the teacher of SMP Negeri 1 Sukoharjo, showing aspects A (formulation of indicators and learning objectives) and aspects of B (learning material) are still at the LOTS level, so they have not been able to improve students' high-level thinking skills. While aspects C (learning model), aspects D (learning activities), aspects E (source and learning media),



and aspects of F (assessment) are included in the good category. That is, these aspects if implemented in mathematics learning can improve students' high-level thinking skills. Based on the results of analysis of data obtained from the study of RPP and interviews it can be concluded that the average design of mathematics teacher learning plans based on higher order thinking skills is included in the good category. These results have not been maximized because there are several aspects that have not led to HOTS. Teachers often use class assessments with exam questions that are only at the level of Lower Order Thinking Skills (LOTS) [17]. Some of the obstacles experienced by teachers in preparing HOTS-based lesson plans are, 1) lack of training in the preparation of HOTSbased RPPs, 2) teachers consider differences in the abilities of each student, and 3) time constraints considering deadlines with various tests. One of the factors that can improve the ability of teachers to develop HOTS learning plans is the participation of teachers in various training related to HOTS learning [18]. HOTS learning training must continue to be carried out by the teacher to keep abreast of developments and improvements in applying HOTS knowledge and skills in mathematics learning [19]. Teachers should be able to recognize the difficulties faced by students in solving problems related to HOTS [20]. Students need to learn HOTS to address the difficulty in generating ideas. HOTS become essential as it can assist them to complete their assignments and learn the subject [21]. This will happen if it starts from good learning planning. Based on the above conclusions, it is necessary to conduct further research on HOTS learning activities until the assessment of HOTS-based classes to improve the ability of teachers in HOTS learning as a whole. So that the teacher's understanding of HOTS learning can improve.

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