

The Ability of Junior High School Mathematics Teachers in Kampar Regency in Developing Higher Order Thinking Skills

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Abstract

Higher Order Thinking Skills are one of the skills that students must master in facing complex situations. These skills can be applied by teachers through Math learning at the junior high school level, therefore Math teachers must be able to facilitate students for Higher Order Thinking Skills questions. The purpose of this study is to identify the ability of the junior high school Math teachers in Kampar Regency in developing HOTS questions. A total of 30 teachers were asked to fill out a questionnaire and compile 2 HOTS questions. The results of the questionnaire were described and the questions made by the teachers were analyzed based on three aspects, namely 1) the topics chosen by the teacher; 2) the classification of questions based on dimensions of cognitive processes; and 3) the classification of questions that meet the Higher Order Thinking Skills category. The findings showed that the teachers chose a variety of topics including numbers, algebra, geometry and measurement, statistics and probability. Based on the dimensions of the Bloom Taxonomy cognitive process, the questions prepared by the teachers include understanding, implementing, analyzing, and evaluating. 25% of the questions were categorized as Higher Order Thinking Skills questions.

Keywords: Junior high school teachers' ability; Higher Order Thinking Skills; problem constructing

INTRODUCTION

One of the objectives of learning mathematics in Permendikbud Number 58 of 2014 concerning the 2013 Junior High School curriculum is solving problems, including the ability to understand problems, design mathematical models, solve models, and interpret the solutions obtained. This is an effort to equip students for the 21st century..

In reality, Setiawati (2019) explained that in the implementation of the National Examination (UN) for Senior High School (SMA) and Madrasah Aliyah (MA) levels which had been attended by around 1,812,565 high school and MA students throughout Indonesia which took place in April 2018 ago, caused problems that have surfaced, especially on social media. Many students complained about the difficulty of UN questions, especially Mathematics questions. As stated by the Minister of Education and Culture, Muhadjir Effendy, this is because the Ministry of Education has started implementing international standards, so that the presentation of UNBK questions is indeed different from the usual assessment, especially in Mathematics and Natural Sciences, both for Mathematics and Literacy, as well as for Natural Sciences, namely questions that require high reasoning power, or Higher Order Thinking Skills (HOTS). Through the application of HOTS (High Level Thinking Skills), the Government expects students to achieve various competencies. These competencies are the skills of the 21st century as well as the target character of students in the evaluation system, namely critical thinking, creative and innovative thinking, communication skills, collaboration skills, and self-confidence. High Order Thinking Skills are applied to raise the standard of UN questions as well as in an effort to improve the rankings of the Program for International Student Assessment (PISA) and

Trends in International Mathematics and Science Study (TIMSS) of Indonesian students which are still low compared to the country other.

If we look more specifically at the phenomenon above, the mean results of the Mathematics National Examination for Junior High School level in Kampar Regency for the last two years, namely 2018 and 2019 respectively, were 36.91 and 42.08, the mean is in the lowest position compared to other subjects. and even occupy a position below the provincial and national average. One of the reasons for the low score of the Mathematics UN is that students are rarely trained and are accustomed to solving HOTS questions, meanwhile, a few percent of the UN questions are HOTS questions.

The increase in the achievement and achievement of students, both in the National Examination, Program for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS), should have been trained and familiarized with solving High Order Thinking Skills / HOTS) starting from Elementary School, Middle School and Senior High School. Students need abstract thinking skills. Thus to train and accustom students to be able to solve HOTS questions, it is a necessity for mathematics teachers at the Primary and Secondary Education levels, they must have the ability to develop HOTS questions which are then given to students in the process of learning mathematics both in formative tests. as well as summative, in order to be able to facilitate these needs. However, the reality in the field shows that junior high school mathematics teachers are still confused in developing questions that measure higher order thinking skills (HOTS) (Rahaju et al, 2018). Likewise, the findings of several previous studies show that there are still many teachers who do not have the ability to develop and compile HOTS questions, such as a study conducted by Rahaju et al. Entitled The Ability of Ponorogo District Middle School Mathematics Teachers in Developing High-Level Thinking Questions. Rahaju, et al (2020) stated that in compiling a high-level thinking category problem, some of the teachers in Ponorogo Regency were still not successful. Some teachers have considered the question that is still in the application category as a high-level thinking problem. Likewise, the results of research conducted by Merta, Lestari, & Setiadi, (2019) on the Higer Order Thinking Skills (HOTS) instrument preparation technique for junior high school teachers, namely only 50% of teachers have the ability to compose HOTS questions in a good category.

According to Hoetomo (2005), the ability comes from the word "able" which means power, can or be able to do something. Kunandar (2008) defines ability is something that is owned by a person to perform tasks and jobs that are assigned to him. The teacher is a professional educator with the main task of educating, teaching, guiding, directing, training, assessing and evaluating students both at the formal early childhood education levels, primary and secondary education. Based on this understanding, the researcher defines that the teacher's ability is the ability and skills of an educator to carry out the task of educating, teaching, guiding, directing, training, assessing and evaluating students in formal early childhood education, primary and secondary education. Lutfi, et al (2013) mentioned 18 professional abilities that teachers must have, including being skilled in providing assistance or guidance to students, and the ability to understand the curriculum and its development. So mastery of HOTS questions is an application of the various professional abilities that teachers must have. The teacher's ability to develop HOTS questions is also a realization of teacher pedagogical competence, namely the ability of teachers in managing student learning, some of which consist of evaluating learning outcomes, and guiding students to actualize their various potentials. So according to Tajudin & Chinnappan (2017) teachers have an important role in improving students' HOTS abilities, because HOTS questions are an assessment based on contextual and reality in everyday life, where through the implementation of HOTS questions students are expected to be able to apply learning concepts in the classroom to solve problems faced by the world community today.

Croslic, in Hanida, et al (2020) states that indicators about HOTS are mathematical explanations, writing mathematical symbols, determining mathematical models, performing calculations and determining solutions. Students who have the ability to apply are not necessarily able to solve problems (problem solving). The ability of students to apply still tends to only repeat processes that have been done (routine), while problems can always be different and generally cannot be solved in the same way (non-

routine). Problem solving actually requires a higher level of thinking than just remembering, understanding, and applying. This level of thinking is called Higher Order Thinking or higher level of thinking. Problems or questions that can trigger high-level skills are complex problems that are not solved by simple memory, but require the application of certain strategies and processes (Sani, 2019). That is why Anderson and Krathwohl categorized the ability of the process of analyzing (analyzing), evaluating (evaluating), and creating (creating) including HOTS. In line with this, Brookhart (2010) shares the same opinion with the higher order thinking concept in Anderson and Krathwohl's revised Bloom's Taxonomy above. Practically Brookhart uses three terms in defining HOTS, namely HOTS as a transfer process, critical thinking and problem solving.

HOTS questions are highly recommended to be used in various forms of classroom assessment and school exams. So the teachers must know the characteristics of HOTS Questions, namely: 1) Measuring higher-order thinking skills, namely the process: analyzing, reflecting, providing arguments (reasons), applying concepts to different situations, composing, creating; 2) Divergent means that it allows students to give different answers according to the thought process and point of view used; 3) Using Multipresentation, HOTS questions generally do not present all information in an explicit manner, but encourage students to dig implied information themselves; 4) Based on contextual problems, HOTS questions are assessments based on real situations in everyday life that are not routine, where students are expected to be able to apply relevant classroom learning concepts to solve problems; 5) Using a variety of problem forms, such as complex multiple choice forms and descriptions.

Setiawati, et al (2019) explained that of the three cognitive levels grouped by Puspendik (2015), namely knowledge and understanding (level 1), application (level 2), and reasoning (level 3), HOTS questions are at the reasoning level (level 3) which includes the dimensions of the thinking process of analyzing (C4), evaluating (C5), and creating (C6), because to answer HOTS questions, students must pass levels 1 and 2, which must be able to remember (C1), understand (C2), and applying (C3) factual, conceptual, and procedural knowledge and having high logic and reasoning so as to be able to solve contextual problems (real situations that are not routine). The steps for preparing HOTS questions in Setawati, et al (2019) are; 1) Analyze KD to be measured, and formulate Competency Achievement Indicators (GPA); 2) Arrange Problem lattices; 3) Choosing the right and contextual stimulus; 4) Write down the question items according to the question grid; 5) Create scoring guidelines (rubric) or answer keys.

METHOD

This research was conducted in Kampar Regency from 02 to 30 October 2020, with the subjects of 30 junior high school mathematics teachers randomly selected from 21 sub-districts in Kampar district, both those who have or not. This type of research is categorized as a qualitative descriptive study. Qualitative research is a research approach that reveals certain social situations by describing reality correctly, formed by words based on relevant data collection and analysis techniques obtained from natural situations without any treatment by the researcher on the subject. Descriptive research is research that aims to determine the circumstances and conditions in which the results are explained in the form of a research report.

The instruments used in this study were questionnaires and documentation, with the following stages: 1) The researcher recorded junior high school mathematics teachers in each sub-district in Kampar district who were willing to be research subjects; 2) The teacher who is the subject of the research is given a questionnaire containing questions about the teacher's understanding and constraints on HOTS questions. The questionnaire was given online (online) to teachers via google form because conditions were still during the Covid-19 pandemic; 3) The answers to the teacher's questionnaire were analyzed and described in percentage terms; 4) The teacher is asked to make 2 HOTS questions consisting of one multiple choice and one description, complete with alternative solutions and grids, with unspecified material, meaning that the teacher is free to choose material from grades VII to IX; 5) HOTS questions made by the teacher were analyzed and then classified as HOTS categories based on cognitive dimensions.

The data analysis technique used is the presentation of data and drawing conclusions. The data presentation was carried out by analyzing the HOTS questions made by the teacher. Then the researcher described the following four points: 1) The teacher's answer to the questionnaire regarding HOTS questions; 2) The topic chosen by the teacher; 3) Classification of questions based on dimensions of cognitive processes; and 4) classification of items that meet the HOTS category of questions. Based on the Mathematics Subject Guidelines, the scope of mathematics consists of 4, namely: 1) Number concepts, operations and patterns, including: integers and fraction numbers, number sequences, number patterns, sequences and series, powers and roots operations; 2) Algebra and relations, including: drawing patterns of shapes and numbers, sets, algebraic and non-algebraic expressions, relations and functions, equations and inequalities (linear and non-linear), comparisons; 3) Geometry and measurement, including: basic units and simple derivative units, plane geometry, congruence and congruence, measurement of distances and angles, comparisons, Pythagorean theorem, transformations; 4) Statistics and opportunities, including: data processing, data presentation, size of concentration and distribution, empirical opportunities, and theoretical opportunities. So the topics that the teacher chooses can be classified into numbers; algebra; geometry and measurement; as well as odds and statistics.

RESULTS AND DISCUSSION

Results

The results of the study were divided into three parts, namely: 1) the teacher's answers to the questionnaire regarding HOTS questions; 2) Classification of topics / materials selected by the teacher; 3) Classification of questions based on dimensions of cognitive processes.

1. The teacher's answer to the questionnaire regarding HOTS questions

The questionnaire consisting of 5 items was compiled on a google form and given via social media WhatsApp. The questionnaire was filled with 30 junior high school mathematics teachers from 21 sub-districts in Kampar Regency, resulting in various answers. Form of answer Many teachers Percentage, The teacher states that he understands the HOTS Question and describes its meaning 25 83.33%, Teachers who said they had never attended training related to the development of HOTS 23 questions 76.67%, Teachers who can explain the skills the teacher must have in developing HOTS 29 questions 96.67%, Teachers who stated that they were able (had no difficulty in making HOTS questions) 7 23.33%, eachers who claim to believe that HOTS 3 can be applied in their schools 10%

2. Grouping the topic / material selected by the teacher

Of the 4 topics in the scope of junior high school mathematics, the most teachers made HOTS questions with algebra topics, including straight line sets and equations. Questions compiled by 30 teachers equipped with grids and alternative answers were analyzed and classified as HOTS questions or not. The classification and percentage of questions are based on the revised Bloom Taxonomy by Anderson and Krathwohl

Discussion

1. Teacher's knowledge and understanding of HOTS questions

Based on the answers to the questionnaire of 30 junior high school mathematics teachers in Kampar district, it shows that most of the teachers already understand what HOTS questions are, and only a small part say they don't understand, such as the following answers:

"That is a question that is designed so that the solution must be carried out through certain steps and stages, so that only the results will be obtained. It is hoped that it can make students accustomed to thinking critically and creatively in solving problems "

"The HOTS question is a kind of evaluation that can see and test students' higher order thinking skills. HOTS questions will hone students' logical thinking, mindset, and creativity "

"The HOTS problem is a question that involves certain concepts. and the questions do not contain direct, express information".

"That is a question which in its completion requires critical thinking and reasoning skills and involves various concepts. But not all difficult questions are about HOTS "

Even some teachers can explain what skills the teacher needs in developing HOTS questions,

"The teacher must be skilled at analyzing various materials, then skilled at distinguishing the difficulty level of the problem or be creative in transforming ordinary questions into HOTS questions"

"Teachers must be able to understand and master operational verbs (C1-C6), know the relevant contextual problems in each material, and be accustomed to transferring material concepts from one material to another or knowledge of other fields of science."

"Skilled in utilizing IT, modifying questions and updating the latest information, skilled in arranging words that are easy for students to understand, imaginative abilities so that there are charts or pictures that stimulate students to think."

"Teachers must be skilled and creative in designing questions and choosing relevant stimuli, especially when providing stimuli related to daily life, having a literate culture, having material competence, teacher insights on global issues".

"Skilled and creative in designing questions with unfamiliar problems, able to evaluate strategies used to solve problems from various perceptions, find more innovative learning models"

Meanwhile, 60% of teachers admitted that they had attended training on the development of Higher Order Thinking Skill questions and had tried making HOTS questions. The teacher also explained their experiences when composing HOTS questions. In general, both teachers who stated that they understood or not, had difficulty making HOTS questions, this can be seen in the answers given by the teacher below:

"There is difficulty in making questions with levels C4, C5 and C6 and it is not easy to distinguish between questions including C4, C5 and C6. And also making the stimulus "

"It's starting to be possible, but the problem is still less varied, because it must always be linked to other disciplines"

"Yes, trouble. Sometimes the questions that we think are HOTS questions do not match the criteria for HOTS questions "

"The difficulty is implied in the matter"

"I'm having a little trouble, because I'm not used to writing HOTS questions, especially since I only received training once, which I don't think is enough."

In general, the difficulty teachers encountered in developing and compiling HOTS questions was finding contextual stimuli that were not routine. As the teacher's answer:

"I have difficulty in the stimulus. Moreover, the stimulus is contextual, meaning that it must be

appropriate in everyday life. "

"I have a little trouble choosing a stimulus"

"I don't think I can afford it, because it is difficult to find problems that make students think at higher levels"

To create a stimulus that is unique and not routine, but relevant to the material, it is necessary to master the material as well as broad literacy and insight. In addition, the teacher's creativity in modifying routine questions into something that looks new and unique is also very much needed in developing this HOTS question.

In terms of teachers' confidence to be able to apply HOTS questions in their schools, only 20% said they could, and 53% said they could not, while the rest expressed doubts, for reasons including:

"The condition of students whose input backgrounds come from elementary school students was not selected. The average person has medium to lower ability. Still, HOTS questions are given but the percentage is not that big".

"Based on my experience when teaching at school, I don't think I am sure that this HOTS question has not been able to be fully applied, because the teacher's knowledge in making HOTS questions cannot be creative and innovative to be able to think at a high level, plus the ability of the students is still good. do not have high reasoning power and less desire to read, understand questions that include higher order thinking "

2. Classification of teacher questions that meet the HOTS category

Based on table 3 about the classification of questions based on cognitive dimensions, there are 73.33% of the objective questions and 70% of the description questions made by the teacher are still in level 2, namely application or application (C3). This shows that the mathematics teachers of SMP Kabupaten Kampar still do not fully understand the criteria for HOTS questions, so the questions at the application stage are considered problems at the level of analysis / reasoning, or because teachers have difficulty finding creative ideas in making stimuli, or what aspects are known. and what to ask, so that it becomes a HOTS question, where 60% of the number of teachers sampled said they already understood and understood what HOTS questions were, but in fact, less than 50% of the questions made were categorized as HOTS, which was only 20% of the objective questions and 26.67% of the description questions that have reached stage C4. while 3.33% had entered the evaluation stage (C5). The following shows Figure 1, Figure 2. Figure 3, and Figure 4 as examples of HOTS questions prepared by the teacher.

In a cage there are 45 chickens, 15 of which are males. Among the roosters there are 7 black tails. If there are 23 black chickens, it can be concluded that the mode of the data is ...

- a. Black rooster
- b. Black hen
- c. Rooster that is not black

d. A hen that is not black

Problem 1 above is a question related to the material of the operation of slices and set combinations, but it is presented in a unique way not in the appearance of the questions usually found in mathematics textbooks and semester exam questions. To solve it, students must analyze the information from the questions, then must be able to present it in a set, and relate it in the concept of slices and combinations of a set. This question looks simple and is actually not difficult if students are able to analyze it correctly, because not all HOTS questions are difficult. However, if students do not understand the concept of slices and combinations of a set, questions that look simple will not be answered correctly.

A private hospital sets parking rates for vehicles with the following conditions:

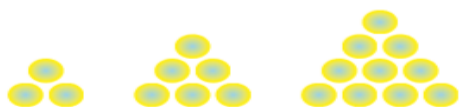
Motorbikes: Rp3,000 for the first hour, and the rate for each subsequent hour is Rp.2,000 per hour

Car: Rp. 5,000 for the first hour, and the rate for every next hour is Rp. 3,000 per hour Mr. Haris wants to stop at the hospital to visit his friend, after buying a package in Mr.

- a. If Mr. Haris is riding a motorcycle, how long will it take for Mr. Haris to be at the hospital the maximum so that Mr. Haris has enough money to pay for parking his motorbike?
- b. If Mr. Haris is driving, how long does it take for Mr. Haris to stay at the hospital the maximum so that Mr. Haris has enough money to pay for parking his car?
- c. Determine the function formula for the problem!

In Problem 2, students are asked to look carefully at the stimulus provided, students try to write down various alternative solutions according to the limitations or rules in the questions based on existing information, without first knowing the function formula. Students are expected to think critically in order to be able to solve the problem by making settlement patterns which of course will lead to a form of function then students can present it in the concept of a function, thus determining the function formula.

Look at the following ball pattern image!



If there are 50 balls then

- A. Can be arranged 8 balls row with 10 balls remaining
- B. Can be arranged in 9 rows of balls with 5 balls remaining
- C. Can be arranged in 10 rows of balls without remaining bricks
- D. You can arrange 11 balls in a row with 1 ball left

Problem 3 is a HOTS question, where in order to evaluate the correct statement of each given option, students must analyze the stimulus in the form of a number sequence pattern, then first find a number sequence pattern, after which students must analyze each option given to determine the statement which according to the pattern that has been found, only then can judge

(evaluate) which statement is correct

CONCLUSIONS AND SUGGESTIONS

The conclusion of this study is that less than 50% of junior high school mathematics teachers in Kampar district understand and are able to develop questions with the Higher Order Thinking Skills category or questions with high-order thinking skills, most of the teachers are only able to arrange questions that are still at the application or application level, so that In the learning process the teacher will find it difficult to familiarize and train students to solve HOTS questions, while the assessments that will be given to students, both at school in summative form, as well as at the national level such as the UN and international levels such as PISA, are always presented in the form of questions. higher order thinking (HOTS). The author's suggestion is that teachers should always try to upgrade themselves through the MGMP or other educational communities to improve their competence in understanding and developing HOTS questions. Likewise for the government and education practitioners, this finding is a big homework, how can the government accommodate and facilitate teachers to get trainings, be it in the form of workshops or more intensive assistance related to the ability of teachers to understand and develop this HOTS question.

REFERENCE

- Abdul Majir. 2019. Blended Learning dalam Pengembangan Pembelajaran suatu tuntutan guna memperoleh Keterampilan Abad-21. *Sebatik 1410-3737* STMIK Widya Cipta Dharma, Samarinda
- Ansari, Bansu Irianto dan Razali Abdullah. 2020. *Higher Order Thinking Skills (HOTS) Bagi Kaum Milenial Melalui Inovasi Pembelajaran Matematika*. Malang : CV IRDH
- Arikunto, S. 2010. *Prosedur Penelitian (Suatu Pendekatan Praktik)*. Bandung: Rineka Cipta
- Ariyana, Yoki dkk. 2019. *Buku Pegangan Pembelajaran Berorientasi pada keterampilan Berpikir tingkat tinggi*. Dirjen GTK Kemendikbud
- Brookhart, S. M. 2010. *How to assess higher-order thinking skills in your classroom*. Alexandria, Virginia: ASCD
- Hanida, E.D.W, Zukhrufrohmah, Dwi, P.U. 2020. Representation Of Mathematics Expression Of Civil Engineering Students In Solving HOTS Problems. *Daya Matematis* Volume ke-8 (hlm. 92-105)
- Hoetomo. 2005. *Kamus Lengkap Bahasa Indonesia*. Surabaya: PT Mitra Pelajar
- Jailani, dkk. 2018. *Desain Pembelajaran Matematika Untuk Melatih Higher Order Thinking Skills*. Yogyakarta: UNY
- Kemendikbud. 2017. Modul Penyusunan Soal Higher Order Thinking Skill (HOTS). Direktorat Pembinaan SMA, Direktorat Jendarl Pendidikan Dasar Dan Menengah. Departemen Pendidikan Dan Kebudayaan.<http://doi.org/1, 0.1017/CBO9781107415324.004>
- Kunandar. 2008. *Guru Profesional Implementasi KTSP dan Sukses dalam Sertifikasi Guru*. Jakarta: Grafindo Persada.
- Lutfi, dkk. 2013. *Sisi lain kebijakan profesionalisme Guru*. Malang : Universitas Brawijaya Press
- Merta, I.W., Lestari, N., & Setiadi, D. 2019. Teknik penyusunan instrumen higher order thinking skillss (HOTS) bagi guru-guru SMP rayon 7 Mataram. *Jurnal Pendidikan dan Pengabdian Masyarakat*, 2(1), 48-53
- Permendikbud Nomor 58 Tahun 2014 Tentang Kurikulum 2013 Sekolah Menengah Pertama/ Madrasah tsanawiyah, Kemendikbud, Jakarta
- Rahaju E.B. & Fardah, D.K. 2018. An identification of Teachers Ability on Posing HOTS mathematics problems. *International Conference on Science and Technology (ICST 2018)*. *Atlantis Highlights in Engineering*, Vol 1.(hlm 75-81)
- Rahaju, E.B., Dini K.F., Pradnyo W., Ismail. 2020. Kemampuan Guru-guru Matematika SMP Kabupaten Ponorogo dalam mengembangkan soal Berpikir Tingkat Tinggi. *JPMR*, Vol.05

- Risnawati, 2008. *Peningkatan Pengembangan Matematika*, Suska Press, Pekanbaru
- Riadi, Arifin. 2016. Problem-Based Learning Meningkatkan Higher-Order Thinking Skills Siswa Kelas VIII SMPN 1 Daha Utara Dan SMPN 2 Daha Utara. *Math Didactic Jurnal Pendidikan Matematika*
- Sani, Ridwan Abdullah. 2019. *Pembelajaran Berbasis HOTS (Higher Order Thinking Skills)*. Tangerang : Tira Smart
- Setiawati, Wiwik dkk. 2019. *Buku penilaian Berorientasi Higher Order Thinking Skills* Dirjen GTK Kemendikbud
- Tajudin, N. M., & Chinnappan, M. 2017. Role of higher order thinking skills in enhancing mathematical problem solving, *Man in India*, 97(17), 209-214