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Higher-order thinking (HOT) oriented learning: exploration of mathematics teachers' perception

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Abstract. Teacher is one of the factors of the success in implementing high-order thinking oriented learning so that students can think at a higher level. In fact, students' high-order thinking skills are still low, so teachers' perceptual information is needed. This study aims to describe the perception of mathematics teachers on HOT-oriented learning from the aspects of (1) curriculum, (2) books, (3) training, and (4) learning activities carried out. The research method used was a survey with a quantitative descriptive approach. The population of this study was 29 state junior high school mathematics teachers in North Banjarmasin Subdistrict. Data was collected through questionnaires and analyzed using a Likert scale, percentage, and mode. The results obtained showed that mathematics teachers had the following perceptions: (1) positive for the 2013 curriculum, (2) positive for books that were with HOT oriented but negative for examples in textbooks easily understood by students, (3) positive for training material that had been followed, (4) positive that planning is needed to construct HOT criteria, increase questioning activities, express opinions, foster creativity, and students' critical thinking skills, but negatively increase the activity of observation, student experimentation, and scheduled timelines.

1. Introduction

Science and technology have developed very rapidly in the 21st century so that innovations are needed to deal with it. The Ministry of Education and Culture also plays role in the innovation by revising the curriculum, in which the 2013 curriculum is gradually implemented. The implementation of the 2013 curriculum was carried out in stages by providing opportunities for teachers to attend training or workshops.

The 2013 curriculum demands to develop HOT-oriented learning. Mathematics as one of the lessons in which the number of class hours is quite significant in the curriculum is potential to develop this HOT-oriented learning. The definition of mathematics itself is the result of human thought that relates to ideas, processes, and reasoning. Therefore, it was expected that learning mathematics becomes the basis for improving the ability to think logically, analytically, systematically, critically. This is by the demands of the HOT curriculum.

In fact, Indonesia is still inferior to other countries in terms of mathematical abilities. The Program for International Student Assessment (PISA) and Trends in the International Mathematics and Science Study (TIMSS) report shows that Indonesian students are only able to reach the second level of the six degrees of thinking on the competed questions. This indicates that students' ability to think logically and rationally is still low so that the rank of the achievements from year to year is still at a low level among other countries [1]. Most of the 7th-grade students are at the level of little thinking skills, and

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almost all students need to improve their high-level thinking skills, especially synthesis and evaluation [2, 3].

One of the weaknesses faced by the world of education in Indonesia is the weak learning process. Students are less encouraged to develop thinking skills, especially high-level thinking [4]. This is supported by [5] that it is necessary to improve the implementation and authentic assessment of HOT-based learning in elementary schools in Medan. The same result is written in [6] that teachers are not quite ready in the implementation of HOT-oriented education even though the role of teachers based on [7] in instilling HOT is an essential aspect of active HOT-oriented learning. The teacher is a component that determines the learning process in the classroom. The 2013 curriculum has begun to be implemented will not be adequately achieved without being balanced by the teacher's ability to perform the curriculum. Teacher professionals are the significantly correlated with the strategies used to instill high-level thinking skills of students [8]. Based on these various thoughts, it is necessary to conduct a study on the the perception of mathematics teachers regarding HOT-oriented learning in junior high school.

Perception is a person's process in interpreting and organizing stimulus patterns that are received by the senses on the environment. Perception involves a high level of cognition in understanding sensory information [9]. Another opinion expressed by [10] that understanding is the process of organizing or interpreting the stimulus received by an organism or individual so that it is meaningful, and it is an integrated activity in the individual. Therefore, perception is a process of interpreting sensory and sensations experienced by someone against the stimulus received.

Research on teacher perceptions in the learning process has been widely studied. Ref [11, 12, 13] discusses teachers' perceptions of the learning they have carried out. There was also a discussion on teachers' perceptions about multicultural and agricultural education programs that had been implemented [14, 15]. History and Malay language teachers have a positive impression of HOT-oriented learning [16, 17]. Perception needs to be investigated because it provides a significant influence on student learning outcomes [18]. The research aims to describe the understanding of mathematics teachers on HOT-oriented learning from aspects of (1) curriculum, (2) books, (3) training, and (4) learning activities carried out.

2. Research Method

The research method used was a survey with a quantitative descriptive approach. The population in this study was the mathematics teachers of State Junior High Schools (SMPN) in North Banjarmasin District, totaling 29 people spread across nine schools. All mathematics teachers were taken as research samples so that they used total sampling techniques. The distribution of the number of math teachers per school is presented in Table 1.

	North Banjarmasin dist	rict
No.	School	Number of mathematics teachers
1	SMPN 13	4
2	SMPN 15	4
3	SMPN 17	3
4	SMPN 21	4
5	SMPN 24	5
6	SMPN 27	2
7	SMPN 29	2
8	SMPN 31	4
9	SMPN 32	1
Number		29

 Table 1. Distribution of number of mathematics teachers in junior high schools in

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There are two mathematics teachers at SMPN 32, but they also teach at SMP 24 so that the data only became one school, namely SMP 24. The data collection technique used in the study was a questionnaire. Data that had been collected was analyzed using a Likert scale, percentage, and mode.

3. Results and Discussion

3.1. Mathematics Teacher's Perception of 2013 Curriculum

The 2013 curriculum has begun to be implemented in junior high schools throughout the North Banjarmasin Sub-district in stages. Some schools in the 2018/2019 school year have not used the 2013 curriculum for grade 9. There are 38% of mathematics teachers providing a negative perception that this curriculum is effective in increasing HOT's ability, so math teachers tend to have a positive understanding of the 2013 curriculum. What applies is designed to develop HOT so that it is expected to make it easier to create strategies and indicators of maximum learning success as revealed [4]. Although mathematics teachers understand that the 2013 curriculum is useful in developing HOT, they still need a workshop or training seriously and in detail to discuss the contents of the 2013 curriculum held by universities. Following the findings of [6], the teacher needs HOT math training.

3.2. Mathematics Teacher's Perception of Books

It is the thing that supports the mathematics teacher in carrying out the learning process in the book. There are two books provided by the government, namely student books and teacher books. There were 17% of teachers giving negative perceptions that student books effectively improved students 'HOT abilities in the learning process, meaning that mathematics teachers tend to have positive opinions of student books to enhance students' HOT skills. Conversely, 72% of teachers have a negative perception that students easily understand the examples written in textbooks. This means that mathematics teachers state that students have difficulty understanding the patterns in the book independently because the ability of students is still low, unable to think highly. These students need to be facilitated by the teacher by giving examples that are simpler and following the conditions of the students. This is developing the statement of [4] that the role of teacher is as a guide and motivator. Teachers are needed to guide students to be able to find their thinking abilities and teachers as motivators to arouse students 'interest by connecting learning materials to be taught with students' needs, adjusting subject matter to the level of experience and abilities of students, and using various strategies.

Likewise, mathematics teachers tend to provide positive perceptions of teacher books, which are useful guidelines for improving HOT-oriented learning. The teacher's book is very supportive of the teacher as reference material and can map subject matter. It supports the teacher's role as a learning resource [4].

3.3. Mathematics Teacher's Perception of Training Materials

Twenty-eight mathamatics teachers in North Banjarmasin Sub-district have participated in the 2013 curriculum training because there was someone who had never attended training. There were 93% of mathematics teachers who participated in the 2013 curriculum training providing a positive perception that the training material that was followed trained the teachers in constructing the questions according to HOT criteria. Mathematics teachers who have obtained content to build queries according to HOT principles feel that the training allocation time is too short compared to the material discussed and are still theoretical, so we need examples of teaching by the 2013 curriculum and talking questions that enhance students' HOT abilities.

3.4. Mathematics Teacher's Perception of Learning Implementation

Teacher, as a driver of the learning process in the classroom, is required to plan. There are 59% of mathematics teachers providing a positive perception that HOT-oriented learning needs planning because it is not easy to construct the HOT criteria problem. Solutions provided [19] include teachers who read more references related to how to build tests that can measure students' high-level thinking skills.

The mathematics teacher's perception in the North Banjarmasin Sub-district during the learning process was HOTS-oriented. Mathematics teachers tend to give positive perceptions that students become more frequently asked; students become more courageous in expressing responses, developing students 'creativity, improving students' critical thinking skills during HOT-oriented learning processes. Positive perceptions of activities enhance students 'critical thinking skills by research [20] that 62.96% of teachers stated that it is essential to involve students' critical thinking skills in HOT-oriented learning.

Mathematics teacher perceptions tend to be negative that students make observations, students do experiments, according to the scheduled time in HOT-oriented learning. If it is associated with five student activities in the scientific approach, based on the perception of the mathematics teacher, HOT education is asking questions and communicating, while those that are not there are observing and trying. It means that the learning process that develops HOT has not maximally activated student activities. Student activities need to be maximized so that students gain knowledge by constructing rather than memorizing because [4] states that the learning process is the process of developing all potential students. Teachers who have professional competence are expected to possess the ability to carry out HOT-oriented learning with various supporting learning strategies. Table 2 presents a summary of the perceptions of Mathematics Teachers in Banjarmasin Utara Sub-district towards HOT-oriented learning.

Ma	Aspect		Perception	
INO.			Negative	
1	2013 curriculum			
	2013 curriculum effectively enhances HOT capabilities			
2	Book			
	Textbooks effectively enhance students' HOT abilities in the learning			
	process			
	Students quickly understand examples written in textbooks			
	The teacher's book is a useful guide to improving HOT-oriented learning			
3	Training followed			
	The training material that was followed trained the teacher in preparing			
	HOT criteria questions			
4	Learning Implementation			
	HOT oriented learning needs planning			
	Students ask questions more often			
	Students become bolder in expressing responses			
	Develops student creativity			
	Improves students' critical thinking skills			
	Students make observations			
	Students conduct experiments			
	Following the scheduled time		\checkmark	

Table 2. Summary of mathematics teachers' perceptions of HOT oriented learning

Based on table 2, it is illustrated that the perception of mathematics teachers in North Banjarmasin Sub-district tends to be positive towards HOT-oriented learning. This is in line with research [21] that the perception of history teachers on the application of higher-level thinking skills in teaching is Journal of Physics: Conference Series

positive. Likewise, it is with [16] that Malay Language teachers have a positive perception of the implementation of HOT in their learning.

All negative perceptions of mathematics teachers in the North Banjarmasin Sub-district are related to students. Teachers assume that the ability of low students will not be able to follow HOT-oriented learning. These difficulties are almost the same as [6], namely, in terms of students' basic knowledge, students have difficulty understanding questions that require high-level thinking. These problems can be overcome, as in [22] that the HOT ability of students can be trained in the learning process in the classroom, which allows students to discover the concept of activity-based knowledge.

4. Conclusion

The mathematics teacher's perception in Banjarmasin Utara Sub-district is as follows: (1) Positive that the 2013 curriculum is useful in developing HOT; (2) Positive that student and teacher books can improve the effectiveness of HOT students in the learning process. It is negative that the examples in the textbook are easy for students to understand; (3) Positive for the 2013 curriculum training material that was once attended by the teacher about the training material compiled the questions that developed HOT students; (4) Positive that HOTS oriented learning needs to be planned, students often ask more questions, express more responses, and foster creativity as well as critical students when implementing learning. Negative to the activities of observation, experimentation, and according to the scheduled time when conducting education.

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