Teacher Skills in Preparing Evaluation Instruments: Case Study of Teacher's Understanding to Construct Hots Instrument

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Article history	Abstract
	Higher-order thinking Skills (HOTS) are 21st-century skills that must be facilitated in learning. However, currently, teachers are having problems understanding and designing HOTS skills instruments. This research aims to determine teachers' understanding in designing HOTS questions and determine the integrity of teachers' knowledge with instruments prepared by Social and Science subject teachers. This research is a mixed-method study with an Explanatory-Sequential Approach design. This research involved eight teachers with varied teaching experience. The results show that teachers lack understanding in preparing HOTS questions where the average achievement is 66.4% in every aspect of preparing HOTS questions. Analysis of the questions used by teachers shows that teachers still use questions at LOTS level (C1-C3). The interview results were coded using N-vivo, teachers had misconceptions about the development of HOTS questions and had different understandings in developing HOTS instruments. Future research can facilitate teachers to develop teachers' HOTS Instrument Preparation skills through training or workshops. .

1. INTRODUCTION

Higher-order thinking Skills (HOTS) are one of the 21st-century skills that students must master in responding to the challenges of the 21st century. HOTS skills are the main foundation for developing other skills related to 21st-century skills. Teachers must be able to adapt learning to answer these challenges and prepare appropriate learning and evaluation of HOTS skills (Kosasih et al., 2022; Surjanti et al., 2022). Preparing HOTS-based learning lessons can facilitate students to develop HOTS skills through learning (Ab Halim et al., 2021; Rosyadi et al., 2022), and preparing evaluations such as developing relevant HOTS questions can help in conducting HOTS-based learning evaluations and can determine appropriate follow-up action based on the evaluation results. However, currently, based on research, students still have problems with HOTS skills so Indonesian students get low achievements in surveys conducted by PISA (Abdullah et al., 2017; Setyarini, 2020;

Suyatna & Viyanti, 2020). This problem has become the center of attention in research, many studies have been carried out to overcome this problem.

Research conducted to optimize the achievement of HOTS skills has been carried out, especially in the evaluation aspect which aims to develop HOTS question instruments that are oriented toward developing application-based tests (Istiyono et al., 2019; Manassero-Mas et al., 2022; Yunita et al., 2021). developed a HOTS-based CAT instrument to obtain accuracy and ease in measuring students' HOTS skills (Yunita et al., 2021). Development of computerized adaptive testing (CAT) to measure higher-order thinking skills (HOTS) in physics learning called PhysTHOTS-CAT (Istiyono, 2018; Istiyono et al., 2019). In the pedagogical aspect, research on HOTS has developed learning that leads to the implementation of 21st-century learning (Carroll et al., 2020; Ibrahim & Elfeky, 2018; Kwangmuang et al., 2021). Research on pedagogical aspects such as the application of Project-Based Learning (PjBL), Inquiry, and even real-life integrated learning such as the use of the Problem-Based Learning (PBL) model which is applied to improve HOTS skills (Hujjatusnaini et al., 2022; Mitarlis et al., 2020; Suherman et al., 2020; Tong et al., 2022). Several studies have even implemented integrated STEM problem-solving based on HOTS (Wahono et al., 2020; Yusuf et al., 2018), and various learning developments that lead to mobile learning based on 21st-century learning (Afikah et al., 2022; Tong et al., 2022). HOTS research on aspects of pedagogy and evaluation has developed rapidly, providing clear information on the development of teaching and measurement. However, research on teachers is still incomplete, especially on the aspect of teacher skills in developing HOTS instruments.

Previous research related to teacher skills in preparing HOTS instruments has been reported by several studies, Rampean et al., (2022) measuring teacher skills using a qualitative approach. The research results show that teachers still have problems with understanding HOTS skills. This affects teachers' skills in developing instruments. This research was only carried out in chemistry lessons and chemical reaction material. Saepuzaman et al., (2020) using a phenomenological study through tests and Focus Group Discussions found that teachers still had problems assessing HOTS skills through appropriate instruments and teachers had difficulty planning, preparing questions, creating stimuli, and combining concepts/formulas. This research only provides an overview of the difficulties in compiling HOTS questions and has not been integrated with the analysis of the questions used. Akbar et al., (2022) conducted a qualitative study using interviews, questionnaires, and document analysis. This research shows that teachers do not understand Bloom's taxonomy, and teachers have difficulty in creating questions and alternative answers to multiple choices. Based on previous research, it can be seen that previous research has not accommodated teachers' knowledge and practices in preparing HOTS questions. However, the results of previous research show that teachers have problems with the development and implementation of the HOTS Instrument.

The results of previous research are also in line with a survey conducted by the Ministry of Education and Culture (Kemendikbud, 2019) which analyzed 1,779 questions used by high school teachers in USBN assistance for 26 subjects in 136 high schools spread across all provinces in Indonesia. The results show that on average the questions designed by teachers are still at level 1 and level 2 in the cognitive aspect, 27 schools can design HOTS questions, and only 28 schools can design HOTS questions. The results of the analysis show that currently, teachers' skills in compiling HOTS questions are still low. The results of teacher evaluations in evaluating students' HOTS skills cannot yet be fully trusted. The results of this survey also reinforce why the results of the evaluation conducted by the Program for International Student Assessment (PISA) state that Indonesia's literacy achievement is still low. Based on the results of the survey conducted, it can be seen that teachers have problems designing HOTS instruments. So the evaluation carried out tends to provide inaccurate information.

Based on previous problems and research related to HOTS, it show that research on teachers' skills in designing HOTS instruments is still limited. Several studies suggest paying attention to teacher competency related to HOTS skills and teacher competency in compiling instruments (Alagan et al., 2020; Driana & Ernawati, 2019; Istiyono, 2018). This research aims to describe teachers' theoretical and practical skills as well as the obstacles for teachers in developing HOTS questions. This problem is an urgent problem that must be resolved immediately because if teachers do not have sufficient skills to create HOTS instruments, the evaluations carried out will tend to

provide inaccurate information so that the innovations carried out cannot lead to the real problem. The research problem formulation used is as follows:

1. What is the teacher's understanding of designing HOTS question instruments?
2. What is the cognitive level of the questions used by teachers in evaluating students? Are the questions used included in the HOTS question category?
3. What are the obstacles for teachers in understanding HOTS questions?

2. METHOD
Research Design
The study uses a Mixed Method with an Explanatory-Sequential Approach using a Participant-Selection Design. This research method has two stages, namely the quantitative research stage followed by the second stage of qualitative research (Edmonds, W & D. Kennedy, 2017). The first stage is quantitative research. This stage is designed to obtain information about teachers' understanding of HOTS skills and teachers' skills in designing HOTS instruments. Data collection uses a Likert scale instrument designed based on general HOTS knowledge and skills in preparing HOTS instruments. The questionnaire used was designed based on aspects from the Ministry of Education and Culture (Kemdikbud, 2019) consisting of five indicators, namely Analysing Basic Competencies (KD), developing Question Grids, Formulating Stimulus, Developing Questions, and Assessment Rubrics.

The second stage is qualitative research which is carried out after the first stage of research has been completed. In the second stage, the participants involved were all the teachers involved in the first stage. The second stage of research aims to find out in depth the difficulties and obstacles experienced by teachers in designing the HOTS instrument. At this stage, data was collected through interviews with teachers who had varied teaching experiences to obtain information regarding teachers' difficulties and obstacles in developing the HOTS instrument.

Participant
This research involved eight teachers from six subjects including Chemistry, Physics, Biology, Geography, Biology, and Indonesian. The teachers involved came from Madrasah Aliyah Labor and Madrasah Aliyah Negeri (MAN) 2 Muaro Jambi who came from Muaro Jambi Regency and Jambi City. The teachers involved were eight teachers who taught in the social and science fields and had varying teaching experience, the lowest teacher experience was two years and the highest was twenty-six years. The selection of samples with a variety of experiences aims to obtain in-depth and varied information. Participants' names use initials to keep the identities of the teachers involved in this research confidential. The teachers involved in the research were teachers who voluntarily wanted to share information related to HOTS instrument design skills without pressure from anywhere.

Research Instrument
The instruments used consist of a questionnaire, question assessment rubric, and interview sheet. The five-scale questionnaire was used to determine teacher knowledge in designing HOTS question instruments. The Question Assessment Rubric is used to assess the questions used by the teacher during the exam. This assessment is carried out to determine the cognitive level of the questions used by the teacher in the exam. Interview sheets were used to determine teachers' difficulties and misconceptions in designing HOTS question instruments.

Data Analysis Technique
The results of the five-scale questionnaire data were analyzed using descriptive and interpreted based on five aspects, namely Analysing Basic Competencies (KD), Designing Question Grids, Formulating Stimulus, developing Questions, and Scoring Rubrics. The exam questions used by teachers are analyzed by experts who have experience in designing HOTS questions. The questions used by the teacher are analyzed by expert validators to determine the cognitive level of the questions. Teacher interview data to determine teachers' obstacles in compiling HOTS instruments was analyzed by coding using the N-vivo application.

3. RESULTS AND DISCUSSION
Teachers need to have a balanced understanding and practical skills in compiling higher-order thinking Skills (HOTS) instruments. The quality of the HOTS instrument produced depends on

the synergy between teacher understanding and practice. The ideas that emerge when compiling the HOTS instrument must be by the understanding required by the teacher, by the characteristics of the HOTS instrument, so that it can produce an accurate evaluation instrument. This research reveals the percentage of teacher understanding that is adjusted to the criteria of the Ministry of Education and Culture (Kemendikbud, 2019), such as Analysis of Basic Competencies, Preparation of Question Grids, Formulation of Stimulus, Development of Questions, and Assessment Rubrics. Analysis was also carried out on the questions used by teachers to assess students' cognitive levels. In addition, this research highlights the obstacles and difficulties faced by teachers in developing HOTS instruments through interviews.

Teacher understanding in designing HOTS question instruments

Measuring teachers' understanding in designing the HOTS Instrument uses a questionnaire designed based on aspects of the HOTS Instrument using criteria from the Ministry of Education and Culture, (2019) which is divided into five aspects. The results of measuring teacher knowledge in designing HOTS instruments are by the following picture.
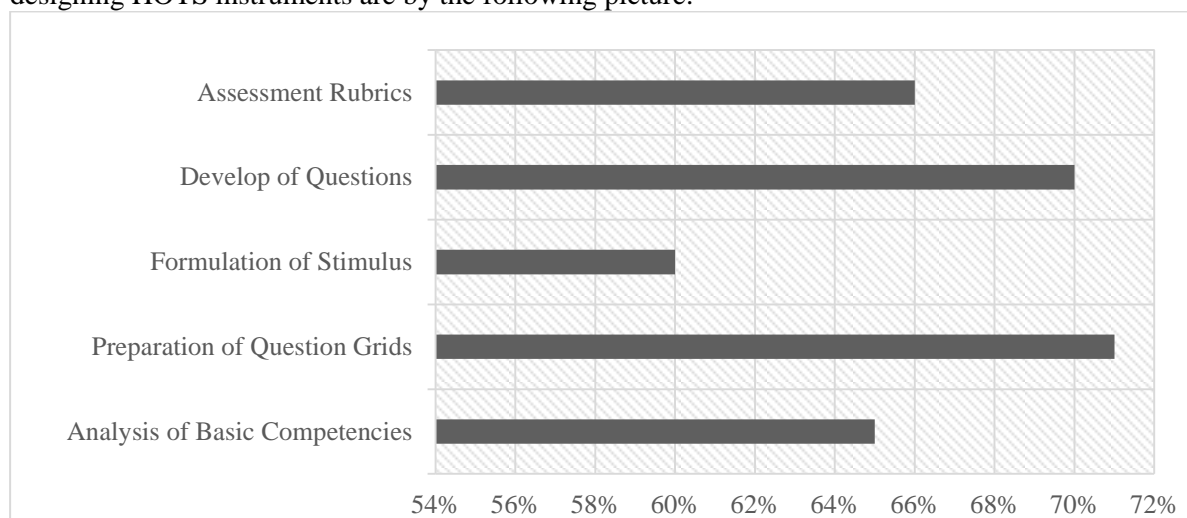

Figure 1. The results of the teacher's understanding of designing HOTS Skills

Even though the cognitive level of HOTS questions in this research is based on Bloom's taxonomy theory, measuring teacher understanding in preparing HOTS questions must be integrated with the HOTS question criteria proposed by the Ministry of Education and Culture, (2019). Teachers must adapt the Analysis of Basic Competencies to teaching, prepare grids, design stimuli develop questions that are in line with the learning being applied, and prepare assessment rubrics based on teaching aspects and questions that have been prepared. Teachers' understanding in designing HOTS instruments is still low where the average percentage of teacher achievement is 66.4%. The aspect of preparing a grid is the highest score where the teacher can understand the procedure for creating a grid of questions based on Basic Competencies. However, in other aspects, teacher achievement is still low, teachers still have problems in composing appropriate sentences for questions and how determine scores to determine student HOTS achievement, especially the essay test instrument scoring rubric. The lowest score is in the aspect of formulating a stimulus. This is in line with the results of the question analysis in Table 1 where the teacher did not use stimuli in preparing the instrument. Questions only test understanding without important information related to the problem given. This shows that teachers' understanding of designing HOTS questions is still limited.

Cognitive Level of instruments question used by teachers for evaluation

Analysis of questions used by teachers aims to determine the cognitive level of questions used by teachers in evaluating students' HOTS skills. The instrument used is analyzed by the validator to determine the cognitive level of the questions. The HOST question instrument analyzed consisted of 7 subjects at Madrasah Aliyah involving eight teachers who had different teaching experiences. Even though the cognitive level of the questions is determined based on the taxonomy level, teachers must understand the aspects proposed by the Ministry of Education and Culture, (2019) as a basis for developing HOTS questions. Taxonomy Level is used to identify HOTS

questions prepared by teachers, while the criteria proposed by the Ministry of Education and Culture, (2019) ensure that the questions used are in line with the learning carried out and have appropriate elements for measuring students' HOTS skills such as analyzing basic competencies. in developing questions and creating question grids based on the learning that has been applied. The results of the question analysis are in Table 1 below:

Table 1: Analysis of questions used by teachers in evaluating students' HOTS skills

Teacher's initial	Learning Experience	Subject	Question	Stimulus	Taxonomy Level					
					C1	C2	C3	C4	C5	C6
MN	20 Years	Chemistry	35 MC 5 E	-	4	14	22	-	-	-
ND	11 Years	Biology	25 MC 5 E	-	21	8	1	-	-	-
JM	14 Years	Physics	35 MC 5 E	-	10	9	21	-	-	-
PS	14 Years	Chemistry	35 MC 5 E	-	1	25	14	-	-	-
JN	2 Years	Indonesian language	25 MC 5 E	-	19	10	1	-	-	-
FT	7 Years	Indonesian language	40 MC 5 E	-	9	29	7	-	-	-
AB	26 Years	Economy	50 MC	2	28	18	4	-	-	-
MK	10 Years	Geography	50 MC	-	46	4	-	-	-	-
Total Number of Questions			325	2	138	117	70	-	-	-

MC = Multiple Choice
E = Essay

Analysis was carried out on 325 questions consisting of 295 multiple choice questions and 30 essay questions from 6 subjects and 8 teachers who had varied teaching experience. The results of the question analysis showed that only the economics subject teacher provided stimulation on the questions, even though it was only 2 questions out of 50 questions. Teachers consider stimulus not important in designing HOTS instruments. Many teachers ignore the stimulus when developing the HOTS instrument. Almost all respondents did not provide stimulation on the questions used to evaluate HOTS skills. The questions given are also only limited to category levels C1, C2, and C3. Not a single instrument was found at levels C4, C5 and C6. This indicates that all respondents have not used the HOTS instrument. The teacher thinks that the questions used are aimed at HOTS skills, but in reality, they are still at levels C1, C2, and C3, namely Lower-Order Thinking Skills (LOTS).

Teachers' Difficulty in Preparing Instruments for HOTS Questions

The results of the interviews were used to describe teachers' difficulties in designing HOTS question instruments. The interviews in this research were conducted after the teacher completed the HOTS understanding questionnaire. Interviews were conducted to explore further information regarding the teacher's understanding of composing HOTS questions. Analysis of teacher difficulties is carried out by experts in identifying teacher mistakes to determine the basis for selecting Basic Competencies, Grids, Stimulus, preparing questions, and designing assessment rubrics. Errors found based on the results of interviews with teachers were grouped and coded to determine teacher misunderstandings in designing HOTS questions. The results of the analysis used word frequency which was used to find out the words that appeared most often from the results of interviews with teachers in compiling HOTS questions. The word frequency results can be seen in Figure 2 below:

Figure 2. Words that appear most often in interviews

Based on the word frequency that appears in the interview results, it can be seen that the word "Material/content" is the word that appears most frequently in the interview. Content is the main point of discussion for participants in composing HOTS questions and the next words are ability, stimulus, and students. This shows that the words that appear are directed toward the HOTS question preparation aspect. Based on the word frequency that appears, it can be identified that content is the teacher's main discussion in solving various problems in preparing HOTS questions. The teacher emphasizes that content is the main thing that needs to be paid attention to. Several things that are of concern to teachers when composing HOTS questions are students' abilities and stimulus in composing HOTS questions.

Interview analysis was also carried out by coding the data to find keywords for teachers' difficulties or misunderstandings in designing HOTS questions. The coding results are then presented in the form of a project map to find out in detail the teacher's mistakes in compiling HOTS questions. The project map in this research is presented in Figure 4 below:

Figure 3. project map Teacher errors in compiling HOTS questions

Based on the project map created based on coding results using N-Vivo, it can be seen that teachers have many misunderstandings in compiling the HOTS instrument. Teachers' difficulties in designing HOTS questions include the aspect of analyzing Basic Competencies where teachers consider that Basic Competencies are not the basis for determining the Instrument to be designed. Even teachers who prepare instrument grids are not based on Basic Competencies. So many questions are arranged based on content without paying attention to Basic Competencies which are indicators of student achievement. Aspects of composing the stimulus. Many teachers think that the stimulus is not important and does not have to be in question. The stimulus is only to test the content, not to stimulate students to solve questions. Another problem is compiling a grid of questions, the teacher does not create a grid but directly uses questions in the student's book or worksheet so that the instrument used cannot describe the student's HOTS abilities. In the aspect of composing questions, teachers have not been able to determine the appropriate type of test to measure HOTS skills. Teachers assume that HOTS questions are based on the difficulty level of the questions and reasoning aspects. The teacher ignores sentence structure in questions that are appropriate to the cognitive level of the HOTS question instrument.

Teacher understanding in designing HOTS instruments is key in evaluating students' improvement in HOTS skills. An appropriate instrument will provide clear information on HOTS skills and evaluations carried out to optimize students' HOTS skills. The results of this research show that teachers still experience problems with formulating instruments according to cognitive level. Teachers are still confused about choosing words that match basic competencies and cognitive levels. Teachers still have problems determining appropriate Basic Competencies that can be used as a basis for developing HOTS question instruments. The teacher considers that stimulus is not the key in designing HOTS questions so the questions used by the teacher are still testing content, not real words and the questions are not directed at using analysis.

Research findings show that teachers have difficulty in developing HOTS instruments, namely that teachers' understanding of the HOTS concept and Bloom's taxonomy is still not deep enough, so they have difficulty distinguishing between low-level thinking and high-level thinking. Teachers' skills in designing questions that require analysis, evaluation, and creation require special skills and experience that not all teachers have. Apart from that, teachers have not fully mastered the HOTS question criteria such as Analysis of Basic Competencies, Preparation of Question Grids, Formulation of Stimulus, Development of Questions, and Assessment Rubrics.

Teachers' difficulties in designing HOTS question instruments are also relevant to previous research where teachers' understanding of designing HOTS questions is still low (Rampean et al., 2022; Saepuzaman et al., 2020). Teachers do not understand Bloom's Taxonomy (Akbar et al., 2022). This problem causes misconceptions in determining levels or criteria C4, C5, and C6. Teachers only use the words analyze, evaluate, and create, not operational verbs (Setyarini, 2020). Another problem in developing HOTS questions is that the development of questions takes a long time to adapt the questions to the content, the level of taxonomy blooms, and a large number of students causes the measurement of HOTS skills to not be optimal (Dahlan, 2020). Teachers' understanding of designing HOTS Instruments is the basis for developing Instruments that can be used to evaluate students' HOTS skills. However, this low understanding becomes a problem in the development of instruments and teachers' measurements of HOTS skills.

The teacher's challenge in preparing the HOTS instrument is not only in the knowledge of HOTS but also in the teacher's understanding of the learning content. Teachers assume that the level of difficulty of the questions is a criterion for HOTS questions and teachers ignore cognitive complexity. Many teachers use questions directly from books without adopting them (Wilson & Narasuman, 2020). Teachers assume that the more difficult the content taught, the greater the opportunity to give HOTS questions. Teachers ignore the preparation of instruments that lead to real-world concepts where the questions given can be found in everyday life but only focus on how to prepare questions that are difficult for students to solve (Surjanti et al., 2022). The fundamental difficulty in preparing HOTS questions also occurs when determining questions that are appropriate for students who lead to HOTS (Setyarini, 2020). The basic problems that must be of concern to teachers' understanding are related to composing problem questions, creating stimuli, combining concepts/formulas, and validating instruments (Alfarisy et al., 2023). Teachers do not yet understand the appropriate answer choices on multiple choice questions to measure HOTS skills, and are still

confused about determining tests such as multiple choice, essays, or open questions that are suitable for evaluating HOTS skills (Akbar et al., 2022; Dahlan, 2020).

The quality of the test questions will provide information on high-level thinking skills and is influenced by internal factors such as the teacher's educational and professional qualifications. Varying teacher perceptions of higher-order thinking skills can cause problems in developing questions based on higher-order thinking (Tyas et al., 2019). these issues need to be resolved to improve educational practice and support the integration of higher-order thinking skills in assessment. Different interpretations show that understanding of HOTS skills is still low (Wilson & Narasuman, 2020).

Understanding how to design HOTS instruments is one of the basics in resolving teachers' difficulties in developing HOTS instruments (Azid et al., 2022; Jensen et al., 2014; Rosyadi et al., 2022). Without a deep understanding of the cognitive level, teachers will tend to compose questions that lead to measuring low-level thinking rather than at the analysis, evaluation, and creation skills stage as high-level thinking skills (Maxnun et al., 2024). Teachers' difficulties in identifying problems in formulating stimuli on the HOTS instrument make it difficult for teachers to formulate questions according to the appropriate cognitive level to measure students' HOTS skills (Surjanti et al., 2022).

This statement shows that teachers need various training for self-development which leads to the preparation of HOTS skills instruments (Saepuzaman et al., 2020). Knowledge development training on preparing HOTS questions is a necessity to improve students' HOTS skills. Facilitating teachers with skills in preparing HOTS questions will provide accurate information on measuring and evaluating students' HOTS skills (Surjanti et al., 2022). However, this research is limited to analyzing teachers' knowledge and skills in compiling HOTS questions. The research did not lead to training or workshops to facilitate teachers in developing skills in preparing HOTS instruments.

Based on the problems and challenges that teachers must solve in preparing HOTS questions, further research is needed that can facilitate teachers to develop HOTS skills, such as training or workshops that lead to the design and preparation of HOTS Skills Instruments. Workshops are a way to increase knowledge of preparing HOTS instruments (Setyarini, 2020). implementing workshops will provide direct benefits for teachers where they will receive direct instructions and guidance to develop instruments (Saepuzaman et al., 2020). Further research can develop and implement appropriate training designs that take into account teachers' needs and constraints in composing HOTS questions.

4. CONCLUSION

The research results show that teachers' understanding of designing HOTS questions is still limited. Teachers still have problems understanding the preparation of the HOTS Instrument. Teachers' understanding and practice shows that teachers still lack understanding in preparing stimuli and teachers have varying views in understanding the development of the HOTS instrument. Based on the questionnaire distributed, teacher knowledge in designing HOTS instruments is 66.4%. Based on the analysis of the instruments used by the teacher, it shows that the questions used are at level C1-C4 in the LOTS category. This shows that teachers do not master the skills in developing HOTS questions. This study has several limitations: there were eight teachers involved and the information presented was only limited to knowledge, question analysis, and teachers' difficulties in developing the HOTS instrument. Future research can develop and implement training to develop HOTS instrument preparation skills for teachers.

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