PREPARATION OF TEST INSTRUMENTS BASED ON HIGHER ORDER THINKING SKILLS AT UPT SPF SDI MANNURUKI 2 MAKASSAR

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Abstract

The background for implementing this community service activity is the lack of understanding of teachers about Higher Order Thinking Skill (HOTS) based tests. This activity aims to improve the ability of teachers at UPT SPF SDI Mannuruki 2 Makassar in the pedagogical competence and professional competence aspects, specifically the ability to prepare Higher Order Thinking Skill (HOTS) based test instruments to be applied to their students. The activity methods are observation and interview, preparation of materials, preparation of supporting data, implementation of activities consisting of training and discussion. The participants were 14 teachers at UPT SPF SDI Mannuruki 2 Makassar, consisting of 12 classroom teachers and 2 subject teachers. At the end of the activity, 11 participants were succeeded in compiling HOTS-based test instruments, but there were 3 participants who did not understand how to compose the HOTS-based test instrument. This indicates that the participants have pedagogical competence and professional competence, because they generally understand and can implement HOTS-based test instruments for students.

Keywords: Higher Order Thinking Skill, Pedagogical Competence, Professional Competence, Test Instrument

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**INTRODUCTION**

Evaluation is one of the important elements for measuring the success of a program. The purpose of conducting an evaluation is to find out whether the implemented program has been successfully delivered to participants well (Coldwell, 2019; Rolfe, 2019). In another opinion, evaluation aims to find out whether the program has met the targets of the program or not (Caicedo et al., 2019; Houser, 2019; Martin, Ritzhaupt, Kumar, & Budhrani, 2019).

In the education field, evaluation is carried out at every type and level. The evaluation is carried out on students, institutions, and educational programs in formal and non-formal channels for all levels, units, and types of education (Evans, 2020; Lai & Bower, 2020). It aims to control the quality of education in a comprehensive and sustainable manner as a form of accountability of education providers to interested parties. In Indonesia, evaluation in education is carried out in accordance with the Law on the National Education System (Khasna, Akbari, & Kurniawan, 2020; Sudiyatno & Wulandari, 2020).

Evaluation is an activity that covers two activities, namely assessment and measurement (Adom, Mensah, & Dake, 2020; Gómez & Valdés, 2019). In general, the purpose of assessment is to find out overall information about the results and learning process, and to monitor the learning progress achieved by students. The assessment result will be more valid if it starts with measurement. In the same vein, assessment is the activity of comparing the results of measuring properties or objects with a relevant reference so as to obtain a qualitative quantity of an object (Lavanya, Murthy, & Kosaraju, 2020; Shaturaev, Iroda, Gulnoza, & Madina, 2020).

According to Brookhart and Nitko (2019), assessment is the process of documenting knowledge, skills, attitudes and beliefs, usually in measurable terms. Therefore, Madani (2019) argued assessment has urgent benefits in determining educational success, namely...
providing a significant impact on every learning activity. Furthermore, Cope, Kalantzis, and Searsmith (2021) emphasized that the results of the assessment are used as a basis for formulating a new policy.

Mølstad, Prøitz, & Dieude (2021) explained the purpose of assessment in the learning curriculum is to assess the abilities of each graduate who takes part in the learning program implemented by teachers. The assessment process is carried out procedurally starting from preparing the test instruments to the results reporting stage which includes affective, knowledge, and skill aspects. The test instrument developed is used as a measuring tool for students’ abilities, a measuring tool that is able to hone students’ abilities to think more critically in solving problems from the subject matter they receive.

Programme for International Student Assessment (PISA) on 2018 reported the results of the study they conducted, namely the ability of Indonesian students in the aspects of understanding information, theory, problem solving analysis, use of instruments in problem solving, in general is still low. This result can be caused by the very low reading literacy, mathematics literacy, and scientific literacy of students in Indonesia. In PISA 2006 Indonesia was ranked 50th out of 57 countries, and in 2009 Indonesia was ranked 60th out of 65 countries. Meanwhile, in PISA 2012, Indonesia was ranked 64th out of 65 participating countries in the scientific literacy ability (Nashruddin, Laksono, Mintowati, Nurhadi, & Qalbi, 2023).

As an effort to respond to these problems, the Indonesian government has made improvements to the 2013 curriculum. One of the improvements to the 2013 curriculum is in content standard, which is enriched with students’ needs for critical and analytical thinking in accordance with the international standard. In addition, assessment standard is given space in the development of assessment instruments that measure higher level thinking (Román-González, Moreno-León, & Robles, 2019). It is hoped that the assessment of learning outcomes can help students to improve their high-level thinking abilities (Higher Order Thinking Skills or HOTS). According to Ichsan, Sigit, et al. (2019) higher order thinking can encourage students to think broadly and deeply about subject matter.

The HOTS-based test instrument is an instrument to measure high-level abilities in problem solving (Çiftci & Bildiren, 2020; Durak, 2020). The characteristics of HOTS-based test instruments are linking different concepts and information, applying processes based on information in solving problems, and reasoning critically based on information. However, the HOTS-based test instrument is not a collection of difficult questions (Dewi, Sholikhah, & Fitrayati, 2020).
The HOTS-based test instrument is an instrument to measure students’ metacognitive aspects. HOTS-based test instruments not only measure factual, conceptual and procedural aspects, but also measure how students describe their abilities by linking several concepts in interpreting, solving problems, discovering new concepts and reasoning well, so that they can make a final correct and appropriate decision (Çiftci & Bildiren, 2020; Talman et al., 2021). Based on HOTS, Bloom’s taxonomy knowledge levels were revised by Anderson & Krathwohl (Anitescu, 2019), consisting of the ability to know, the ability to understand, the ability to apply, the ability to analyze, the ability to evaluate, and the ability to create. Thus, a test is said to be HOTS-based if the test is able to measure students’ abilities at the levels of analysis, evaluation and creation (Fajarianingtyas, Akbar, & Herowati, 2019).

The results of research on the abilities of students in Indonesia show that generally Indonesian students do not have high-level thinking abilities. Indonesian students are generally used to testing instruments at a low level (C1–C3), so that students find it very difficult to solve problems that require mathematical reasoning, and difficult to solve problems that require high critical thinking skills. This is in line with the results of research conducted by Ichsan, Hasanah, Aini, Ristanto, and Miarsyah (2019) that in the learning process, to measure students’ competence, teachers tend to use questions at a low level (C1-C3), and it is difficult to innovate in developing questions at a high level (C4-C6). The results of that research indicate that teachers’ abilities in developing evaluation of learning outcomes and mastery of HOTS-based material concepts are still low. This is an indicator that teacher competence in pedagogical and professional aspects is still low.

That reality was also experienced by teachers in UPT SPF SDI Mannuruki 2 Makassar. From the results of the meeting held by the team with the Principal and teachers on August 30 2023, the following information was obtained:

1. When compiling test instruments, teachers do not create test grids
2. In compiling test instruments, teachers take them from reference books or download them from the internet, without paying attention to the abilities to be measured
3. The test instruments prepared by the teacher are at a low level (C1-C3)

After this information had been studied in depth, and analyzed based on literature study, it could be seen that the problem was caused by low teacher competence, especially in the pedagogical and professional aspects. The three pieces of information obtained as previously explained were the indicators. In short, teachers in UPT SPF SDI Mannuruki 2 Makassar did not yet have the ability to compose test instruments that could improve students’ high-level thinking abilities. Therefore, this community service activity was carried out in the form of a workshop. The aim of this activity is to provide training in preparing
HOTS-based test instruments to teachers at UPT SPF SDI Mannuruki 2 Makassar so that they can be implemented in the learning process and in assessing students’ competency.

METHOD

This community service activity was carried out at UPT SPF SDI Mannuruki 2 Makassar on October 7, 2023, with 14 participants divided into different class groups. The activity started at 8 a.m. until 5 p.m. (Central Indonesian Time). The methods used in implementing this activity are: (1) Observation and interview, (2) preparation of the material, (3) preparation of the supporting data, and (4) implementation of activities consisting of training and discussions. The following are the activity steps.

1. Preparation

At the preparation stage, the observation and interviews, material preparation, and supporting data preparation were carried out. The Observation was made on the learning process in UPT SPF SDI Mannuruki 2 Makassar find out what problems exist in the teaching and learning process. Interviews were conducted with teachers to obtain an overview of teachers’ difficulties in compiling HOTS-based test instruments. Furthermore, interviews with students were carried out to obtain an initial picture of the implementation of tests carried out by teachers at school. After information about the problem is obtained, supporting materials and data are prepared as a solution to be implemented in the implementation phase. The material and supporting data prepared are related to HOTS-based test instruments.

2. Implementation of Activities

The implementation is divided into 2 activities, namely training and discussion. In the training activity, material is presented to participants to provide a general overview of the HOTS instrument so that the HOTS instrument can be understood by the participants. Participants in this training were divided into 2 groups, namely the low class group (teachers who teach in the 1st grade to the 3rd grade), and high class groups (teachers who teach in the 4th grade to the 6th grade). During the activity the participants were accompanied by the presenter. After presenting the material regarding test instruments, the activity continued with presentations from each group. The methods used in this activity are lecture, performance, and discussion. The problems experienced by teachers and the methods of implementing activities can be seen in the following table 1.
Table 1. Problems and Methods of Implementing Activities

<table>
<thead>
<tr>
<th>Problems</th>
<th>Methods of Implementing Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers’ understanding about HOTS-based test instruments is still low</td>
<td>Using the lecturing method to explain the nature of HOTS.</td>
</tr>
<tr>
<td>Teachers’ skill in preparing tests based on HOTS which can develop students' critical thinking power is still low</td>
<td>Providing the training and assistance in developing HOTS-based tests from preparation to assessment reporting.</td>
</tr>
</tbody>
</table>

RESULT AND DISCUSSION

Result

In implementing the learning process, assessment is one of the elements required in the curriculum. Assessment is used as a very essential component in learning. The success or failure of learning can be determined through the assessment process. Therefore, assessment is used as a tool to evaluate learning. The interview process conducted with teachers to obtain an overview of teachers’ difficulties in compiling HOTS-based test instruments can be seen in the following figure 1.

Figure 1. An Interview Process with Teachers

The main difficulties faced by teachers in UPT SPF SDI Mannuruki 2 Makassar is the lack of understanding in developing HOTS-based test instruments. Teachers still lack understanding of various aspects, such as facts, concepts, procedures and high-level thinking skills to solve problems. Related to the problems experienced by teachers at UPT SPF SDI Mannuruki 2 Makassar, a team consisting of lecturers of Universitas Muslim Maros and Universitas Muhammadiyah Bima, carry out a *tridharma* activity, namely community service, assisted by a teacher of UPT SPF SDI Mannuruki 2 Makassar.
The title of this activity is “Preparation of Test Instruments Based on Higher Order Thinking Skill at UPT SPF SDI Mannuruki 2 Makassar”. The aim of this activity is to provide training in developing tests based on Higher Order Thinking Skills (HOTS) to teachers at UPT SPF SDI Mannuruki 2 Makassar, so that teachers can understand the HOTS-based test instrument. Furthermore, these test instruments can be implemented by teachers in the learning process and during assessments to measure students’ abilities.

The initial preparation stage for the workshop activity at UPT SPF SDI Mannuruki 2 Makassar is shown in the following figure 2. This stage was carried out to gather information about problems experienced by teachers related to the preparation of HOTS-based test instruments. The HOTS-based test instrument is an instrument for measuring high-level abilities in problem solving. The characteristics of HOTS-based test instruments are linking different concepts and information, applying processes based on information in solving problems, and reasoning critically based on information. However, the HOTS-based test instrument is not a collection of difficult questions.

![Figure 2. The Initial Preparation Stage](image)

The HOTS-based test instrument is an instrument to measure students’ metacognitive aspects. It measures students' ability to describe knowledge by linking several concepts to solve problems, discover new concepts, and reason well, so that they can make the right final decision. A test is said to be HOTS if the instrument is able to measure abilities at a high level, namely being able to carry out analysis, evaluate and be creative. The next stage is carrying out the measurement on the test instrument. The first step of the measurement is validation. The HOTS-based test instruments that have been prepared by teachers of UPT SPF SDI Mannuruki 2 Makassar are validated by 5 experts. The following
Table 2 shows one of the validation measurement results of the the HOTS-based test instrument prepared by the teacher of class IV for the mathematics subject.

<table>
<thead>
<tr>
<th>Experts/Validators</th>
<th>Validators' Assessment</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relevant</td>
<td>3.00</td>
</tr>
<tr>
<td>2</td>
<td>Relevant</td>
<td>3.00</td>
</tr>
<tr>
<td>3</td>
<td>Relevant</td>
<td>3.00</td>
</tr>
<tr>
<td>4</td>
<td>Relevant</td>
<td>3.00</td>
</tr>
<tr>
<td>5</td>
<td>Less Relevant</td>
<td>2.85</td>
</tr>
</tbody>
</table>

Average Score 2.97
Category Relevant

Table 2 shows that the HOTS test instrument and the key answers had been validated by experts. After several revisions were made according to the validators’ suggestion and comment, the test instrument was finally categorized as relevant and suitable for use without revision.

Those valid test instruments were applied to measure students’ abilities at high level. An example of a summary of the test instrument measurement results applied to the IV grade students in the mathematics lesson is presented in the following table 3.

<table>
<thead>
<tr>
<th>Students’ Score</th>
<th>Package A Frequency</th>
<th>Package A Percentage</th>
<th>Package A Frequency</th>
<th>Package A Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>81-100</td>
<td>9</td>
<td>30.00%</td>
<td>11</td>
<td>36.67%</td>
</tr>
<tr>
<td>61-80</td>
<td>16</td>
<td>53.33%</td>
<td>15</td>
<td>50.00%</td>
</tr>
<tr>
<td>41-60</td>
<td>0</td>
<td>0.00%</td>
<td>1</td>
<td>3.33%</td>
</tr>
<tr>
<td>21-40</td>
<td>5</td>
<td>16.67%</td>
<td>3</td>
<td>10.00%</td>
</tr>
<tr>
<td>0-20</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Very good
Good
Moderate
Poor
Very poor

It is known from the table 3, based on the measurement result of the HOTS test instrument which was tested on 30 students, in package A, 9 students (30%) were categorized as having very good HOTS abilities, 16 students (53.33%) were categorized as having good HOTS abilities, and 5 students (16.67%) were categorized as having poor HOTS abilities. There were not students (0%) who had moderate and very poor HOTS abilities. In package...
B, 11 students (36.67%) were categorized as having very good HOTS abilities, 15 students (50%) were categorized as having good HOTS abilities, 1 student (3.33%) was categorized as having moderate HOTS abilities, 3 students (10%) were categorized as having poor HOTS ability, and no students (0%) were categorized as having very poor HOTS ability.

In general, 14 teachers of UPT SPF SDI Mannuruki 2 Makassar as participants of this workshop activity, understand well and are able to apply HOTS-based test instruments. This means that they already have the expected competencies. The results of the observation and interview with those teachers regarding knowledge and competence in preparing HOTS test instrument is presented in following table 4.

<table>
<thead>
<tr>
<th>Items</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding HOTS-based test instrument</td>
<td>14</td>
<td>100%</td>
</tr>
<tr>
<td>Understanding test able to develop students’ critical thinking</td>
<td>14</td>
<td>100%</td>
</tr>
<tr>
<td>Ability to compile questions based on HOTS</td>
<td>11</td>
<td>78.57%</td>
</tr>
<tr>
<td>Ability to prepare key answers based on HOTS</td>
<td>11</td>
<td>78.57%</td>
</tr>
</tbody>
</table>

From the interview result shown in the table 4, it is known that 14 teachers (100%) as participants in this workshop activity have understood HOTS-based test instrument and test that is able to develop students' critical thinking. Participants' activities during the workshop were also observed. From the observation result shown in table 4, 11 teachers (78.57%) have the ability to compile questions and prepare key answers, based on HOTS. It means, there are still 3 teachers (21.43%) who do not understand how to compose the HOTS-based test instrument.

**Discussion**

Knowledge regarding HOTS-based test instruments needs to be possessed by every educator in carrying out learning using a scientific approach. In Indonesia, according to the 2013 curriculum regarding assessment standards, schools or educators are given the autonomy to develop assessment instruments to measure higher level thinking, according to the characteristics of each school and student. Thus, educators are expected to be able to develop HOTS-based instruments. It develops the research result of Coldwell (2019) that if students are familiar with high level tests, they will be able to solve questions with different levels of difficulty.

This community service activity was carried out at SD Inpres Mannuruki 2 Makassar on October 7, 2023, with 14 participants divided into different class groups. The activity
A service activity was conducted, which started at 8 a.m. until 5 p.m. (Central Indonesian Time). The expected output from this service activity is grid products and test instruments. Implementation is divided into 2 activities, namely training and discussion. The presentation of the material in the training is carried out to provide a general overview of HOTS so that teachers have insight into HOTS. At the start of the activity, brainstorming was carried out for 15 minutes, to obtain an initial view of the teacher's initial understanding, and to assess their initial understanding regarding the concept of preparing HOTS-based test instruments.

In the material presentation activity, the presenter explained the meaning and characteristics of HOTS, and the steps for developing HOTS-based test instruments. The material presentation in the workshop activity can be seen in the following figure 3.

During the presentation of the material, one of the training participants asked about taxonomy, especially the differences between operational verbs in Bloom’s taxonomy. Other participants asked about knowledge and psychomotor aspects. Furthermore, other participants also asked about the meaning of stimulus in relation to the HOTS question-based instrument.

The speaker explained that the concept of taxonomy is a criterion used by educators in evaluating the quality of learning carried out by an educator. The presentation of the material develops the previous concept proposed by Román-González et al. (2019) that taxonomy is an operational verb that describes the competencies to be obtained through learning. Operational verbs are used as a reference for formulating indicators by educators when developing learning tools.

Educators often experience difficulty in placing learning content because Bloom's taxonomy is linear. The revision of Boloom’s taxonomy carried out by Anderson and
Krathwohl was to change nouns into verbs (Anderson et al., 2001). Each affective, cognitive, and psychomotor aspect has a different indicator formulation. The speaker explained that the taxonomy currently used is Bloom’s taxonomy as a result of revision by Anderson and Krathwohl. It can be said that this workshop activity is an embodiment of the differences between Bloom’s Taxonomy and Anderson & Krathwohl in the cognitive aspect, as presented in table 5.

**Table 5. The Differences between Bloom’s Taxonomy and the Revision of Anderson & Krathwohl**

<table>
<thead>
<tr>
<th>Bloom’s Taxonomy</th>
<th>Anderson &amp; Krathwohl Taxonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Memorizing</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Understanding</td>
</tr>
<tr>
<td>Application</td>
<td>Applying</td>
</tr>
<tr>
<td>Analysis</td>
<td>Analyzing</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Evaluating</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Creating</td>
</tr>
</tbody>
</table>

The speaker also explained that stimulus is stimulation. In the context of preparing HOTS-based test instruments, stimulus is the basis for formulating a question (Dewi et al., 2020; Ichsan, Sigit, et al., 2019). However, in this workshop, a broader implementation was developed compared to the findings in those previous research. In the context of developing a HOTS-based test instrument, the stimulus must be contextual and interesting, developed from global issues, culture, customs, or regional cases or various advantages found in certain regions. Educators are required to be creative and innovative, because this will affect the quality of the test instruments produced.

After the material had been explained by the presenter, participants practised preparing HOTS-based test instruments based on the material that had been explained. All participants showed the results of their work. It can be seen in the following figure 4. During the practice of preparing tests, several teachers had not completed the process of preparing the requested questions, due to the time constraint. It was also found that several participants prepared instruments from scratch, because they had never made instruments at all. Several other participants only revised the questions they already had, because they had previously prepared grids and test instruments. For participants who already have question grids and instruments, the presenter provides guidance to them for correction, while
participants who have not completed the questions are given the opportunity to compose the questions at home and continue discussing via the Whatsapp application.

Figure 4. A Participant Shows Her Work

As the result of this workshop activity, participants generally have already mastered the intended competencies. This is indicated with 11 of 14 participants understand well and are able to apply HOTS-based test instruments. Different from the concept proposed by Lavanya et al. (2020), the implementation of the HOTS-based test instrument preparation workshop was supported by several factors, namely:
1. Participants have high interest and enthusiasm to take part in the training activity
2. Participants have high curiosity about the materials.

On the other hand, there are three other participants who do not understand and are not able to apply the HOTS-based test instrument. The obstacle they experience is their weak mastery of technology, which we know current learning cannot be separated from the application of technology. Therefore, teachers must have the ability to utilize technology in learning, included in preparing the test. Another obstacle is that they have not prepared their test grid well in advance of this workshop. In addition, there are inhibiting factors in this activity, namely:
1. The level of teachers’ recognition of Bloom’s taxonomy is still low
2. Limited training time
3. A small number of participants did not bring the question documents they had previously composed.

From the results of the discussion at the end of the activity, the participants conveyed their hopes to the community service team, namely:
1. The numbers of participants are increased, namely by inviting teachers from other nearby schools
2. Other trainings are provided on the programmed and scheduled basis, for examples: assistance in compiling innovative teaching materials, integrated learning with information technology, and training for writing scientific papers.

CONCLUSION

The community service activity entitled “Preparation of Test Instruments Based on Higher Order Thinking Skill at UPT SPF SDI Mannuruki 2 Makassar” successfully implemented, although a small number of workshop participants did not understand and were unable to apply the HOTS-based test instrument. In general, the series of the workshop activity were successfully implemented. Thus, the majority of teachers already have pedagogical competence and professional competence, because they already understand well and can implement HOTS-based test instruments. The quantitative evidence is shown in table 4 that 11 of the 14 participants are able to compile questions and prepare key answers, based on HOTS. In addition, only a small number of them (3 participants) do not understand and are not able to apply the instruments in the learning and assessment process. The obstacles are the weakness their technology mastery and their lack of preparation. This activity received a good response from all participants because all participants participated enthusiastically from the start to the end of the activity. Another indicator of the success of this activity can be seen from the active involvement of participants in discussions, and the collection of products in the form of grids and test instruments that they developed.

There are two suggestions for the next community service activities. Firstly, teachers need to be given workshops on mastering technological competence, because the technological competence can support teachers’ pedagogical competence and professional competence. Secondly, for teachers who have not been successful in this workshop activity, they need to be given additional guidance periodically, especially regarding preparation of test instruments based on HOTS.

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