

Development of Single Variable Linear Equation System Question Instruments Based on Higher Order Thinking Skill (HOTS)

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Abstract

The 2013 curriculum requires learners to be able to think of high levels or HOTS that suit the needs of competence in the 21st century. Based on the results of the study stated if, the ranking of learners in Indonesia is still relatively low because learners are still weak in solving problems that require reasoning and analysis. So it can be concluded that the purpose of this research is to develop HOTS-based SPLSV problems in SMP / MTs that are valid, practical, and effective. This research is a research development (research and development). The test subjects in this study were class VII students at MTS I Attanwir, with a population of 40 students, and to focus the data, selected 3 students who represented from high, medium, and low abilities. The analysis used in this study is a test of validity by expert material, validity of the problem, differentiating power, difficulty level, rehabilitation test, and t-test testing. The results of the study suggest that a set of SPLSV problem instruments can be used to train high-level thinking skills in learners.

Keywords: Development; Instrument; HOTS

How to cite : Maratin, H., & Shodikin, A. (2022). Development of Single Variable Linear Equation System Question Instruments Based on Higher Order Thinking Skill (HOTS). *Pedagogi: Jurnal Ilmu Pendidikan*, 22(1). <https://doi.org/https://doi.org/10.24036/pedagogi.v22i1.1247>



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INTRODUCTION

Education has become a basic need for mankind, which is why when the man is born to know nothing. But humans already have the basic ability that is fitroh which they must develop to the limit of their abilities. Education has an important role in the survival of human beings because humans are born without knowledge, so education is what they need.

Education makes the interaction between an educator and learners. Education serves to develop potential in learners both potentially and in actual. Learners can think critically and have the ability to think at a high level. The revised 2013 curriculum requires an educator to be able to implement the learning that can train learners to think critically and have the skills to think high level or HOTS. Higher-order thinking skills (HOTS) are the ability to connect and channel knowledge and experience that has been possessed toto improve a more critical and creative mindset (Wulandari et al., 2020). HOTS is closely related to critical thinking. The ability to think critically is an essential campaign in all aspects of life, not least in education. The ability to think at a high level that has been expressed Surya & Syahputra (2017) stated that you have to be able to compete in the everyday world and the world of work. Higher-order thinking skills (HOTS) are so important in learning mathematics because Higher order thinking skills (HOTS) must use a broad mindset so that they will find a problem that students are required to be able to take a solution or decision (Khan & Inamullah, 2011). This is very similar to the main purpose of learning.

Explained at the 21st century to improve and promote a high-level thinking campaign of a student (Rusilowati et al., 2016).

A high level of thinking quality for students is needed a widespread thought process, to find new defiance and new science, which can be obtained from manipulating a piece of information that has been obtained to answer all possibilities in new situations (Surya & Syahputra, 2017). Students can not only gain basic skills but must be able to master how to take a solution/decision, make a plan and be able to solve problems (Tan & Halili, 2015). Students urgently need development in a higher thinking pattern so that it can be used in their lives.

Brookhart stated that the matter of Higher order thinking skills (HOTS) is very important to be given to learners (Sa'idah et al., 2018). This is because the matter of Higher order thinking skills (HOTS) is believed to be able to improve education today. But the shadow of the learners finds it very difficult. The cause is that learners very rarely receive the question of Higher order thinking skills (HOTS) in the defense that every day he does in school. Khan & Inamullah (2011) said that there are still many learners who only accept lots-shaped questions, while evaluation is very rarely given to learners. This is under what has been expressed by (Sangpom et al., 2016) which also states that students are often only given a tracking of materials, formulas, and memorization of formulas and theories contained in the material.

The process of high-level thinking is closely related to Blom taxonomy. Because Blom Taxonomy contains the dimensions of learning or cognitive processes that learners achieve in a learning process (Haolader et al., 2015). According to Bloom stated, there are six levels of learning ways of thinking, namely; C1 (remembering), C2 (understanding), C3 (application), C4 (analyze), C5 (evaluating), and C6 (creating) (Rosnawati, 2009). C1 C2 and C3 levels are low thinking levels, while C4 C5 and C6 are high thinking levels.

One of the results of international learning that has evaluated the ability to think high in learners, namely the Trend In Mathematics and Science Study (TIMSS) which has been held by the IEA, which obtained the results that Indonesia gets a lift of 45 out of 48 countries that have been reviewed (Rosnawati, 2013). So based on the results of the review, it can be concluded that Indonesia has qualified learners whose high-level way of thinking is still relatively low.

While some studies on HOTS state that the role of tests on HOTS is still very low. This was stated by Efendi who stated that the results from TIMSS that the achievement of participants in Indonesia to the cognitive aspects is still low (Wulandari et al., 2020). The causative factor of the low cognitive aspects of learners is the lack of training of learners in completing test problems and those that are evaluation, analysis, and creative. Then it will experience the development of instrument problems based on HOTS, so that it can be expected for an educator to be able to measure precisely the way of high-level thinking skills of his learners, and can melt learners in solving HOTS-based problems, to support the educational capacity in Indonesia.

METHODS

This research uses a type of development research, namely research and development (Suhady et al., 2020) to obtain modeling for development. In this case, the researcher refers to the research from Borg and Gall that there are seven steps at the stage of development, namely the gathering of information, the design of activities, the improvement, limited experiments, improvements, field experiments, and final results.

The study will be limited to class VII students at MTS I Attanwir, with a population of 40 students, and to focus data, selected 3 students who represent from high, medium, and low abilities. In this case, it uses the material system of One Variable Linear Equation (SPLSV), which consists of a type of HOTS problem. Studies that will be used in this study are the legality of the problem, the level of difficulty, and the reliability of the test.

FINDING AND DISCUSSIONS

Based on the results of research that researchers conducted, it produced a set of instruments about the One Variable Linear Equation System (SPLSV) based on HOTS. It was carried out around the researchers by using 3 students who represented high, medium, and low abilities. to measure the student's high-level thinking campaign against SPLSV material.

In the early stages, researchers dig up information to support the results of the study. The collection of information involves an education worker and learners, to get a problem. Based on the results of a survey of educators at MTs I Attanwir stated that there is still a relatively low provision of information or material involving HOTS. Based on this information, researchers need to develop hots to support the ability to think at a high level of learners.

The first step that can be done is to design the grid of questions, then from the grid is developed into several problems that later the problem will be done validity test, by expert experts. In this case, one of the Lecturers of Mathematics Education from UNISDA Lamongan.

The results of validity that have been carried out by experts, showing the presentation of three aspects, namely: aspects of material determination: 83.75%, construction aspects: 94%, and language aspects: 88.5%. So it will get an average of 88.7% which can be concluded that the problem is fairly valid. Based on the analysis that will be tested there are 3 valid questions from 10 questions that have been submitted by researchers. That way it can be stated if the validity in the matter of Higher order thinking skills (HOTS) is high (Husnawati et al., 2019). While from invalid problems, researchers will not use in trials in the field. While in the test of the differentiating power of the problem and the difficulty level of the problem can be calculated after the problems have been validated and revised. Here is an example of the results of the problem item that has passed validation, which can be seen in the figure below.

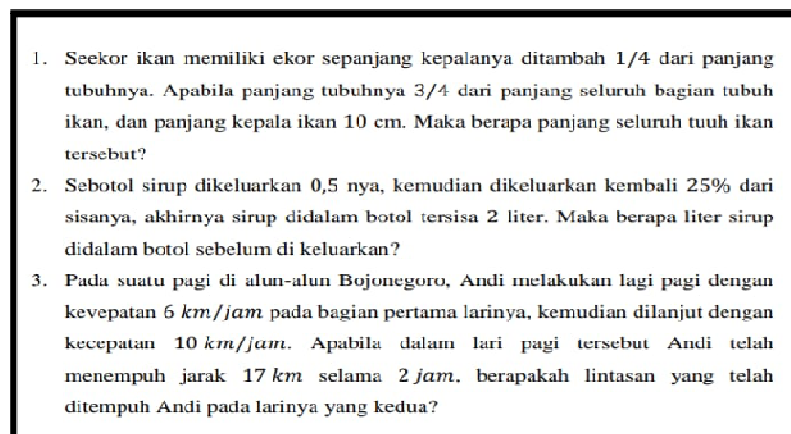
- 
1. Seekor ikan memiliki ekor sepanjang kepalanya ditambah $\frac{1}{4}$ dari panjang tubuhnya. Apabila panjang tubuhnya $\frac{3}{4}$ dari panjang seluruh bagian tubuh ikan, dan panjang kepala ikan 10 cm. Maka berapa panjang seluruh tubuh ikan tersebut?
 2. Sebotal sirup dikeluarkan 0,5 nya, kemudian dikeluarkan kembali 25% dari sisanya, akhirnya sirup didalam botol tersisa 2 liter. Maka berapa liter sirup didalam botol sebelum di keluarkan?
 3. Pada suatu pagi di alun-alun Bojonegoro, Andi melakukan lari pagi dengan kecepatan 5 km/jam pada bagian pertama larinya, kemudian dilanjutkan dengan kecepatan 10 km/jam. Apabila dalam lari pagi tersebut Andi telah menempuh jarak 17 km selama 2 jam, berapakah lintasan yang telah ditempuh Andi pada larinya yang kedua?

Figure 1. Results of the problem items that have passed validation

Higher-order thinking skills (HOTS) can train learners to think at a high level, such as analyzing and evaluating a problem (Suryapuspitarini et al., 2018). The most important thing in kurikulum 2013 is to carry out high-level thinking that is required for all learners.

The results of increasing the point of the researcher's question have calculated its differentiating power, as well as the level of difficulty. The next step is to calculate the reliability of the problem. And getting the rehabilitation value of the problem against a limited trial resulted in a value of 0.89 with a table of 0.322. So from these results showed that the rehabilitation of the problem is high (Husnawati et al., 2019). While from the collection of material validity by expert experts and has been tried on a limited basis obtained results if the hots-based problem instrument is declared feasibility when used in the field.

After the test in the field is carried out, and internal effectiveness analysis is carried out based on the level of questions that have a high level of thinking. In this case, the loading of the grid indicator is using the cognitive realm of high-level thinking. High-level cognitive areas that will be used in this high-level thinking problem instrument include C4 C5 and C6 (Saraswati & Agustika, 2020). In this case, internal effectiveness produces C4:40%, C5:40%, and C6:20%. Furthermore, an external effectiveness analysis will be conducted, to find out whether the problem can be used to measure the ability to think at high levels of learners or not. So the researchers compared the problem that has been considered valid with the OSN Math problem using a t-test.

Based on the t-test test resulted that, there is no differentiator between the instrument of HOTS problem with the problem OSN Mathematics. So obtained H0: Instruments about HOTS developed have not been able to measure the student's high-level thinking campaign then H0 is rejected, while H1: The instrument on HOTS developed can measure the student's high-level thinking campaign then H1 is accepted. So it can be concluded that H0 is rejected and H1 is accepted.

It is very important to know if the improvement of high-level thinking skills depends on the need for the development of a skill, as well as approaches that are by the expression of persuasive reasons in an argument (Vangermeersch, 2020). And a need for the development of higher-order thinking skills (HOTS) instruments to find learners are accustomed to scientific literacy (Rusilowati et al., 2016). Therefore, higher-order thinking skills (HOTS) instruments can greatly make learners apply high-level thinking patterns, which is by the application of the 2013 curriculum.

CONCLUSION

This development can be declared worthy of a review of the validity of experts in the field of mathematics and effectiveness analysis internally as well as externally. Based on the results of the study obtained the validity of the material from expert experts, who have an average of one percent so that it can be considered valid. And the effectiveness analysis internally produces C4:40%, C5:40%, and C6:20%. And external effectiveness analysis results in the result that, there is no differentiator between instruments of HOTS problems with MATHEMATICAL OSN problems. Therefore, the conclusion states that this HOTS-based problem instrument has external effects that can calculate high-level thinking skills for students.

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