

# The Development of HOTS Problems on Algebra for Junior High School

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**Abstract**— This study aimed at producing valid and practical HOTS questions and investigating the potential effects on the student's score. This study was design research with the type of development studies consisting of two stages, the preliminary and the formative evaluation. This research was conducted on class VIII students of SMP Negeri 1 Palembang, which include walkthrough, documentation, interviews, and tests for data collection. Validation is applied based on the validator's assessment of questions regarding content, construction, language, and comments or suggestions of students at each stage of clarity and readability. From the results of the student's work in the field test, it can be seen that the questions developed can lead to higher-level thinking skills. The high-level thinking ability that emerges is analyzing (C4), Evaluating (C5), and Creating (C6) is being able to design a way to solve a problem, generalize an idea or perspective on something and organize elements or parts into structures. This research had produced HOTS question as much as ten questions of valid and practical algebra material and had a potential effect and feasible to used.

**Keywords:** *design research, HOTS, algebra*

## I. INTRODUCTION

In facing the globalization era challenge and problem-solving process in daily life, someone required to be able to use higher-order thinking skills (HOTS), the thinking not only rely on memory but also needed Critical thinking skill even creative. It is line with curriculum 2013 from revision 2017 that the students are expected to be able to communicate, collaborate, think logically and critical, creative, and can innovate in studying. In Mathematics, the students do not only have the ability using calculation or formula in doing test questions only but also expected to be able to use reasoning and anality capability in facing the problems. This problem-solving, not merely a problem in routine question form but also non-routine. Mathematic questions in curriculum 2013 are mostly the question with Higher Order Thinking Skill (HOTS) type. Along with that, by the development of curriculum 2013,

National test exam questions in 2018 have used type of HOTS category as much 10—15% [1].

The constant thinking pattern of HOTS, in the globalization era, can equip the students to compete even able to still alive in unconstant and uncertain conditions [2]. According to [3], Higher Order Thinking Skill through give unusual and unpredictable problems can empower the student, so thinking level is said success when students can explain, determine, formulate, and able to solve the problem by using existing knowledge and experience. The thinking ability of HOTS should be embedded for Indonesian students to raise the creative industry in the future, technology renewal, and welcome global development [4].

Higher-Order Thinking Skill (HOTS) is the questions that demand Higher Order Thinking Skill, thinking ability that is not just recalled, restate, or refer without doing recite. HOTS questions measure the ability: 1) transfer one concept to other concepts, (2) processes and apply information, (3) find out the connection from some information differently, 4) use information for solving the problem, 5) analyze idea and information critically [4]. [3] defines HOTS is the thinking ability include critical thinking, logical, reflective, metacognitive, and creative. HOTS Indicator and descriptor refer to taxonomy bloom, and there are HOTS (High skill) and LOTs (Low skill). According to [5] Taxonomy Bloom HOTS revision is the ability that involves analysis, evaluation, and produce. Analysis categories consist of differentiating descriptors, organizing, and attributing. The evaluation category consists of check and criticize. Then, the category descriptor produce is generating, planning, and producing.

According to [6], High Order Thinking Skills (HOTS) are thinking ability that consists of logic and reasoning ability, analysis, evaluation, creation, problem-solving, and judgment. [7] High Order Thinking Skills is the ability to connect, manipulating, and transforming the knowledge and experience that has been had for thinking critically and creatively in the

effort to determine decisions and solve the problem in the new situation.

It should be aware that HOTS in this development era is far needed. It caused thinking habits and HOTS mindset in the future, will be the students' provision is competing at the condition that is always change, not sure, and will compete in the globalization era [2]. Critical Thinking Skills very useful for facing problems in daily life [8]. Therefore, in the learning process of the education area, improving the student's ability in high order and critical thinking, the students are able to train and guide in doing category materials of HOTS questions. But, in fact, explain that the student's ability level to ward HOTS questions are still low and needed the collection of HOTS questions. It is similar to the research result done by [2] about HOTS. The research result done in Palembang, concludes that more than 50% of students are not able to finish the questions that measure Higher Order Thinking Skill. It figured from: (1) A lot of students are still difficult in analyzing and producing information that exists on problems. (2) the students are difficult in synthesizing, interpreting, and evaluating ideas in solving the problem; (3) the students are not able yet to produce generalization generally from a problem. Next, it still left the economic growth to indicate still low of the higher-order thinking skills and competition skill in global competition that had by Indonesian society. One cause of this condition is the Indonesian government has not able to create education clime well and being able to accommodate the students in improving thinking abilities [2]. Then, it was strengthened in 2018; the national test score on Junior High School level is decreased, it is caused by the students have difficulty in finishing HOTS questions that continue to be developed on the National test question, and the students have not been used it [1]. Because of that, it can be concluded that is still very needed the collection of the questions of HOTS category to support higher-order thinking skills and also the exercises in doing HOTS category questions so that the students are getting the habit.

Based on the description above, there searcher interested to do there search entitled "Development of Higher Level Thinking Questions (HOTS) for Junior Algebraic Materials".

## II. RESEARCH METHOD

This research used Design Research type development studies. This study consisted of two stages: preliminary and formative evaluation stages, including self-evaluation, expert reviews and one-to-one, small group, and field test [9-10]. This research aimed to produce the question of High Order Thinking (HOTS) of Junior High School Algebra material and for seeing academic potential 2018/2019. The research subject is the students of Junior High School State 1 Palembang. The method used in this study is design research with the type of development studies.

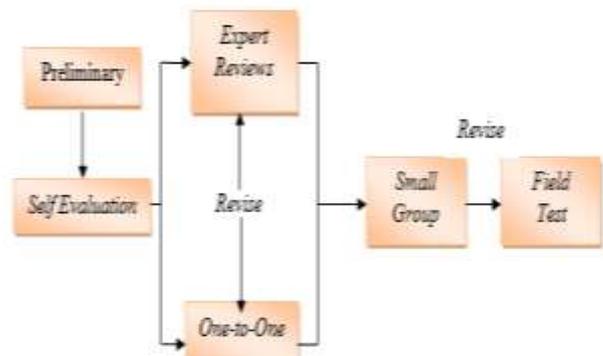


Fig. 1. The flow chart of Formative Evaluation Design [9-10]

## III. RESULTS AND DISCUSSION

The question that produced by the developing question was HOTS mathematics question of Junior High School Algebra material. Two steps discussed in this chapter, namely the preliminary and formative evaluation step. The formative evaluation step consisted of self-evaluation, expert reviews and one-to-one, small group, and field test.

### A. Preliminary Step

At this stage, we set the junior high school level as a learning location and class VIII students as research subjects. In the initial steps, we contacted the school and mathematics teacher to ask for research procedures and schedules. Next, we design the problem instrument for algebra material hots with indicators analyzing (C4), evaluating (C5), creating (C6) consisting of a grid of questions, question cards, and scoring rubrics. The result of the preliminary stage is the initial prototype, and the resulting questions are 11 items. In this paper, we discuss the development of HOTS algebra material on the topic of a linear inequality. The problem is looking for the value of profits from the sale of goods. Basic algebraic concepts such as understanding the process of calculating addition, subtraction, multiplication, and division in general as well as calculating equation form to be able to overcome this problem. The context used is the object that is often used in the learning process, namely the dictionary. The process used is to translate the form of numbers into the form of inequality operations, and the level of prediction of questions is the level of evaluating (C5).

### B. Formative Evaluation Step

#### 1) Self Evaluation

In this step, the researcher re-review the main prototype design that has been designed by checking the compatibility of question instrument with HOTS indicator associated with curriculum 2013 and adjusted by learning materials that learned at school, seen by the content term, construct, and language. The result of this self-evaluation gotten prototype 1.

#### 2) Expert Reviews and One-to-One

On expert reviews step, the questions validation checked from the content term, construct, and language by the thesis supervisor, Somakim moreover, the researcher also ask opinion

from some experts who have been experienced as the expert validator. Those validators are Dr. Destiniar, M.Pd. (at University of PGRI Palembang) and Dr. Bambang Suprihatin, M.Si. (MIPA Lecturer at Sriwijaya University).

The validation process with Destiniar and Bambang Suprihatin are done face to face. Next, validation continued to peer, Mathematics teacher, namely Nurjannah, done by face to face at Junior High School State 1 Palembang.

Based on comment/suggestion from expert review and one-to-one, so the questions on prototype 1 then revised and re-repaired so that it is being valid prototype 2 and will be tried out on small group steps. The question revision decision that developed based on expert reviews and one-to-one suggestion/comment can be seen in table 1:

TABLE I. THE DECISION OF QUESTION REVISION THAT DEVELOPED BASED ON EXPERT REVIEWS AND ONE-TO-ONE SUGGESTION/COMMENT

Before revision	After Revision
<p>In order to get the profit from selling English dictionary, the owner of the book store knows that total income from selling per week. R should exceed the total of cost per week B. If n states the amount of English dictionary that sold out per week <math>R = 120n</math>, and <math>B = 150N + 330</math>, How many English dictionaries that should be sold so that the owner of the book store get the profit?</p> 	<p>In order to get the profit of selling the English dictionary, the owner of the book store knows that total income from selling per week. With notes, R should exceed the total cost per week B. if n states the amount Of English Dictionary that sold out per week <math>R = 120n</math>, and <math>B = 150n + 330</math>. How should many minimal English dictionaries be sold so that the owner of the book store gets the profit?</p> 

**3) Small-Group**

In this phase, the problem was tested on six students with different abilities. The six students are YO, MN, MS, SA, CA, RP. Based on the small group phase, it can be concluded that the six students have understood the problem, questions, and instructions contained in the problem. In the work of hot questions Most students do not have difficulty in answering questions and are able to answer problems correctly, but there are still students who have difficulty in working on problems so as to produce errors in the results of the answers. Based on the small group phase, a matter not been revised in terms of content, construct, and language. We got the prototype 3 valid and practical. Practicality has seen from the ease of students in understanding the problem. Prototype 3 is then tested in the field test phase (field test) to find out the potential effects of the questions developed. We present Prototype 3 in Figure 2.



In order to get the profit of selling english dictionary, the owner of book store knows that total income from selling per week. With notes R should exceed the total cost per week B. if n states the amount Of English Dictionary that sold out per week  $R = 120n$ , and  $B = 150n + 330$ . How many minimal english dictionary that should be sold so that the owner of book store get the profit?

Fig. 2. Prototype 3 HOTS level evaluating (C5)

**4) Field Test**

On-field test step, prototype 3 is tried out on research subject, namely the students of Junior High School State 1 Palembang class VIII as much as 28 students. After finish, the students fill the questionnaire to know students respond set toward the question that is done. Then the researcher analyzes student's answer results to know what potential effect appears from the questions developed by the researcher.



Fig. 3. The students' activity on the field-test step

These following questions discussion and students' answers result in field test steps to see the potential effect that is seen by students process in doing the questions with them strategy.

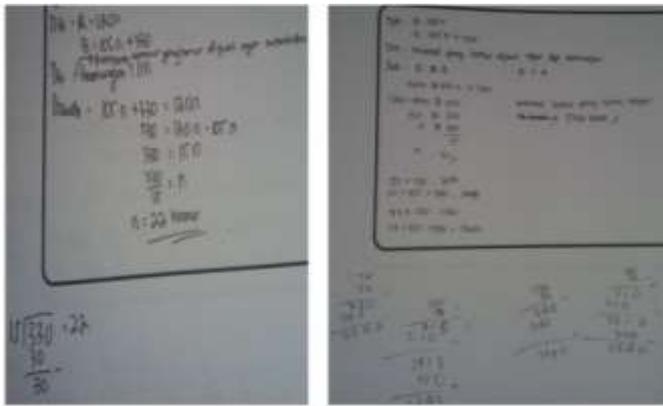


Fig. 4. the answer to question number 2

On the first answer sheet, the students can determine the steps answer accurately, seen by doing the recheck process and checking the answer truth that written following the evaluating indicator (C5). Whereas for the second answer sheet, although in first prosses, the students have written the answer accurately and have tried to do the test of the answer truth that written on checking process and recheck the answer, it has the mistake, so that is being less accurate.

From answer analysis results from 28 students in doing a field, test are over that answer appropriate evaluating ability indicator (C5) based on the percentage of students' test result, 46% Students have had evaluating ability (C5).

#### IV. CONCLUSION

This research had produced HOTs mathematic questions as much as ten valid and practice questions and had a potential effect and feasible to be used. The validity of questions showed from the validator's evaluation result on expert reviews step where their searcher got suggestions and comment from the content term, construct, and language. The validity was also gotten from students' comments and suggestions on one-to-one steps toward the question legibility. For practicality on small group step, the students had had to understand HOTs mathematic questions well. The questions that developed had

potential effect seen by field test result, bring up analyzing (C-4), Evaluating (C-5), and Producing (C-6) ability.

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