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## DEVELOPMENT OF ASSESSMENT HOTS (HIGHER ORDER THINKING SKILLS) BASED ON TROUBLESHOOTING FOR CLASS V SD / MI

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Submit: 27 Mei 2020, Revision: 17 Juni 2020, Approve: 19 Mei 2021

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### Abstract

This research is motivated by the problems that occur, namely students have basically carried out a HOTS-based teaching and learning process or are oriented towards higher-order thinking skills, but during the evaluation process, the measuring instruments or questions used have not been able to measure students' high-level thinking skills. . The type of research to be conducted is Research and Development or R&D (Research and Development). This research refers to the Borg and Gall model which is limited to 7 stages from 10 initial stages, which include potentials and problems, data collection, product design, design validation, design revision, product testing and design revision. The instrument used is in the form of a rating scale to determine the feasibility of the product and to determine the response of educators and students to the feasibility and attractiveness of the product using a Likert scale. Data analysis was carried out, namely collecting data from the validation results of evaluation experts, material experts and language experts, educators and students of SD / MI. HOTS assessment based on problem solving which was developed "Very Feasible or Very Interesting" to be used as a tool for students to train their abilities in higher order thinking. This acquisition was obtained based on product validation by evaluation experts, material experts and linguists. The results of the evaluation from the evaluation expert reached the "Very Appropriate" category with a percentage of 83.84%. The results of the assessment of the material expert received the "Very Appropriate" category with the percentage obtained, namely 88.33%. Whereas in the results of the linguist's assessment the percentage obtained was 87.77% with the category "Very Appropriate".

**Keywords :** Assessment, HOTS, Problem Solving

**Pengutipan:** Anifa Rosari Ulum, dkk. (2021). Development of Assessment HOTS (Higher Order Thinking Skills) Based on Troubleshooting for Class V SD/MI. *JMIE: Journal of Madrasah Ibtidaiyah Education*, 5(1), 2021, 15-29. [jmie.v5i1.222](http://dx.doi.org/10.32934/jmie.v5i1.222).

**Permalink/DOI:** <http://dx.doi.org/10.32934/jmie.v5i1.222>

## INTRODUCTION

Education in the era of the Industrial Revolution 4.0 is directed at developing 21st century competencies which consist of three main components, namely competence to think, act and live in the world. One of the components is thinking competence which includes critical thinking, creative thinking and problem solving abilities (Purwadi, 2019). The 2013 curriculum is an integrated curriculum. A curriculum that removes the boundaries between various subjects and presents materials in unit or whole form is a form of an integrated curriculum (Poerwati and Amri, 2013). 21st century education prepares young people who are creative, flexible, capable of critical thinking, and able to make the right decisions, and are skilled in solving problems (Sani, 2019).

Educators can provide a stimulus to students to seek activity-based and meaningful knowledge concepts. Such as contextual learning, where students are able to build knowledge through personal experience. Contextual learning at the primary school level can be provided during thematic learning (Subadar, 2017). The presence of the curriculum is closely related to educational goals, as stated in Law no. 20 of 2003 which contains the National Goals and Goals of Madrasahs or Institutions related to the terms of Core Competencies, Basic Competencies, and Competency Standards for Graduates (Lubis, Maulana Arafat and Azizana, 2019). The 2013 curriculum is designed to improve critical and analytical thinking (Widana, 2017). Broadly speaking, the basis for critical thinking skills is the ability to think on difficult reasoning power. This HOTS foundation emphasizes the ability to think analytically as well as the efforts of educators in training students' higher order thinking skills by developing elements in learning that do not only refer to memory or memorization but to analysis and solve a problem (Fazriani et al., 2019).

Students are expected to be able to predict, estimate, and design as required and become a requirement of the 2013 Curriculum. Along with this statement, the field of Higher Order Thinking Skills or what can be called HOTS includes the analysis process (C4), evaluation (C5), and creating (C6). It means that in critical thinking skills learners must understand and evaluate information and when the information comes in or comes students must be able to think deeply in order to make a conclusion (Syaeful Hidayat et al., 2020). Educators will more easily transfer knowledge if it is obtained from learning activities using creative, critical and problem-solving thinking skills. These competencies will be needed in the 21st century (Pipit Ambarsari & Cristiano, 2013). All subjects are carried out through school exams or madrasah exams to determine whether these students graduate from the related educational institutions. Students must get a score equal to or greater than the minimum score set by the BSNP to be able to take the school or madrasah exam (Kartowagiran, 2015).

A way to help an educator in knowing the level of understanding of students' knowledge after learning an ability is by conducting an assessment or assessment. Therefore, if you want to improve the thinking power of students, you must design assessment instruments properly and in accordance with the level of cognitive abilities possessed by each student. As it is well known that the assessment should not only be carried out at the end of the lesson but also carried out while the teaching and learning process is in progress. The ability to think critically, metacognitive, reflective, logical and creative is a higher order thinking skill (Ministry of Education and Culture, 2016). The main objective in learning is to improve creative thinking

and higher order thinking skills. Students in elementary schools must begin to be trained in their ability to think at a higher order level, but also remain in their portion. In other words, students are trained according to development and age because students in primary schools have a great curiosity and need more attention. Creative and critical thinking is a characteristic of higher order thinking skills (Hidayati, 2017).

Regulation of the minister of education and culture of the republic of Indonesia number 104 of 2014 concerning the assessment of learning outcomes by educators on thinking ability is the ability to remember, understand, apply, analyze, evaluate and create. In relation to the application in the learning process, capital is needed for students to have the ability to think critically in solving problems that require students to think highly and integrate in real life. (Yulistianti & Megawati, 2019). One of the lessons that can be applied to solve this problem is by applying problem-based learning (Problem Solving). The Problem Solving learning model trains students to find information and cross-check the validity of that information with other sources, also Problem Solving trains students to think critically and this model trains students to solve dilemmas (Ariyanto et al., 2018).

There is no ability from educators to develop HOTS-based assessment instruments. Mrs. Titi Mirasari, S.Pd, as homeroom teacher for class V MI Darul Huda Bandar Lampung said that she had used the assessment to assess students in the teaching and learning process, but she realized that the assessment used was not in accordance with the instructions from the 2013 Curriculum which used higher-order thinking assessments. He also said that HOTS-based assessment is important to give especially to high-class students so that students get used to thinking critically and creatively. However, due to internal and external factors, HOTS-based learning and assessment processes have not been carried out.

In training high-order and critical thinking skills, HOTS-based assessments made by educators can be used as a solution in this regard. An educator must have the ability to improve the HOTS-based teaching and learning process and the HOTS-based assessment. However, until now there has been no training forum or workshop for educators so that they can apply the HOTS-based teaching and learning process as requested by the 2013 Curriculum especially from the Ministry of Religion of Lampung Province. In line with the statement from Mrs. Titi Mirasari, S.Pd, Mrs. Septi Novita Sari, S.Pd as homeroom teacher of class V MI Al-Fajar Pringsewu, said that he had implemented thematic learning in accordance with the 2013 Curriculum but the assessment used was not in accordance with the expectations of the 2013 Curriculum which required students to practice higher-order thinking using HOTS-based learning and HOTS-based assessments. Actually, educators have also tried to develop the existing assessment but it was not successful to implement it due to the lack of the ability of educators to develop the assessment. On the other hand, educators have not received training or workshops due to the lack of information regarding the HOTS-based assessment instrument development training carried out by the Ministry of Education and Culture, especially in Lampung itself. The novelty in this research is in the aspects of the developed thematic oriented problem, and types of question instruments in the form of essays or descriptions. So that students can think and use reasoning that hones their abilities directly to solve problems.

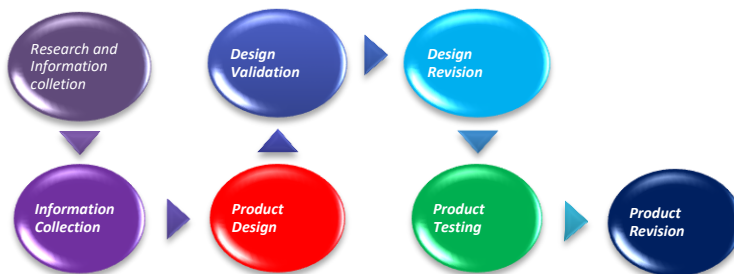
From the identification of problems in the field, it is known that the teaching and learning process has not been based on problem-based learning and is solved by problem solving. Therefore, the authors integrated the HOTS assessment development with problem-solving based learning. In improving higher order thinking skills, a learning model with problem solving can be used. From this explanation, the researcher tries to provide a solution by carrying out "Development of HOTS (Higher Order Thinking Skills) Assessment Based on Problem Solving in Theme 6 of Class V SD / MI".

## METHOD

This research uses research and development methods. Research and Development or R&D is a research method used in the manufacture of certain products as well as to test and test the effectiveness of the products produced. (Sudaryono, 2018). Producing certain products is the main objective of this research and development (Sugiyono, 2017). The use of research and development methods from Borg and Gall which has been modified by Sugiono was selected in this research.

Research and Development Borg and Gall uses ten steps which are limited. The limitation of development to only the seventh stage is carried out because there are several factors that do not support it if it is carried out up to ten steps. Based on the explanation by Borg and Gall, which states that the development to be carried out may be limited, especially if the financial resources are insufficient. The limited step is the eighth step of the trial on a broad scale,

Then what has to be done is that the product revision is used to perfect a product that is produced and ends with the implementation or application on a wide scale. This implementation is of course done by holding a national seminar and a contract is carried out in collaboration between the product maker and the publisher. This activity certainly requires a lot of money and time. So that research that is only for writing a thesis, thesis, or dissertation is allowed to limit its development to the seven steps (Hashim, 2016). The following are the seven steps or procedures established by Borg and Gall in research and development that have been varied with the steps in Figure 1. as follows (Sugiyono, 2017):



**Picture 1.** Research Steps

The data analysis in this study was in the form of an expert validator eligibility questionnaire using a Likert scale. The instrument used has 5 answers in table 1, namely:

**Table 1.** Expert Validation Assessment Score

Score	Eligibility Answers Options
5	Very good
4	Good
3	Enough
2	Not good
1	Very Poor

Calculated using the percentage formula as follows:

$$P = \frac{f}{N} \times 100\%$$

Information:

P = Percentage number or assessment score

$f$  = The frequency for which the percentage is being sought

N = The maximum number of frequencies

The results of the score using the Likert scale rating are then sought for the average of the trial subjects to determine the quality and feasibility of the product according to the experts.

**Table 2.** Feasibility Scale Table

Assessment	Eligibility category
0% - 20%	Very Unworthy
21% - 40%	Not feasible
41% - 60%	Decent enough
61% - 80%	Well worth it
81% - 100%	Very Worth it

Based on the feasibility scale contained in the table above, it can be seen how much the feasibility percentage of the product is produced. The percentage of eligibility that can be used in school is <61%.

## RESULTS AND DISCUSSION

### Research result

The main result of this research and development is a product in the form of a Heat and Transfer 6 Theme Assessment. This research and development uses the Borg & Gall model which is limited to the 7th stage. The results data from each stage of research and development carried out are as follows:

## 1. Potential Problems

Before developing a problem-solving-based HOTS Assessment, the initial activity carried out was to conduct a needs analysis in two madrasas, namely MI Darul Huda Bandar Lampung and MI Al-Fajar Pringsewu. This needs analysis is obtained by conducting preliminary data collection or pre-research through interviews by educators and student questionnaires. From this pre-research, the problem can be identified that is, students have never conducted HOTS-based evaluations which are oriented towards higher order thinking skills. During teaching and learning activities, HOTS learning has actually been implemented indirectly because K13 requires critical abilities of students. So that there is a gap between the needs of students and the facts experienced by students. On the other hand, there are obstacles from educators who have not been able to develop *assessment* HOTS is problem-solving based and students have not been trained to be able to think at high levels because educators do not implement teaching and learning activities and use HOTS-based assessments.

## 2. Information Gathering

The collection of information for this research was carried out at MI Darul Huda Bandar Lampung and MI Al-Fajar Pringsewu, by filling out a questionnaire for educators and students. Then the results of filling out the questionnaire are analyzed as a basis for preparing the background of the problem.

## 3. Product Design

After collecting the data obtained through interviews with educators and then supported by information from books, journals and the internet, the next step is designing the HOTS assessment. Researchers began designing assessments using Microsoft Word and Adobe Illustrator software to design book covers. The paper used is JIS B5 paper. The process of designing the assessment by measuring the size of the paper, after the size is adjusted, then the process of compiling the content of the assessment. The field of Higher Order Thinking Skills or what can be called HOTS includes the process of analysis (C4), evaluation (C5), and creating (C6) (Yoki Ariyana, Ari Pudjiastuti, 2019). In accordance with the HOTS question preparation procedure, the first is to analyze Basic Competence (KD), the second is to make a question grid, the third analyzes the form of the questions to be used, then the fourth makes the questions and the last one makes the answer keys and scoring guidelines. So that students do not get bored when working on questions, the author completes the HOTS questions with pictures, diagrams, relevant graphs and the use of problems or cases that exist in the surrounding environment. The HOTS assessment is designed as a tool used to train students in higher order thinking and to assist educators in carrying out the assessment process through problem solving. relevant graphs and use problems or cases in the surrounding environment. The HOTS assessment is designed as a tool used to train students in higher order thinking and to assist educators in carrying out the assessment process through problem solving. relevant graphs and use problems or cases in the surrounding environment. The HOTS assessment is designed as a tool used to train students in higher order thinking and to assist educators in carrying out the assessment process through problem solving.

According to Polya, there are four indicators of problem solving, namely understanding the problem, planning solutions, solving problems according to the plan and checking again (Harlinda Fatmawati et al: 2015). This assessment was developed to improve the high-order thinking skills of grade 5 students through subject matter 6 covering 3 sub-themes and 150 questions. The following is a grid of questions developed:

**Table 3** Subtheme 1, 2 and 3 grids

Class : V				
Theme : 6 (Heat and Transfer)				
Subtema : 2 (Heat Transfer Around Us)				
No.	Lesson Content	KD	Indicator	Question Number
1.	IPA	3.6	C4	3, 5, 6
			C5	4
		4.6	C4	1, 2, 13, 21, 23, 31
			C5	15, 25, 34
2.	IPS	3.2	C4	7, 10, 44, 47
			C5	11, 12, 18, 19, 32,37, 43
			C5	24, 41, 45
		4.2	C6	46
3.	SBdP	3.3	C4	9, 29
			C5	8, 17
		4.3	C6	20, 22, 40
4.	Civics	3.2	C5	38, 49
		4.2	C5	16, 26, 27, 39
5.	Indonesian	3.3	C4	28
			C5	33, 35, 36, 42
		4.3	C4	30, 50
			C5	14
			C6	48
Class : V				
Theme : 6 (Heat and Transfer)				
Subtema : 3 (Effect of Heat on Life)				
No.	Lesson Content	KD	Indicator	Question Number
1.	IPA	3.6	C4	1, 24
			C5	38
		4.6	C4	15, 20, 21, 39, 42
			C5	2, 3, 4, 35, 46
			C6	5
2.	IPS	3.2	C4	31
			C5	16, 18, 28, 29, 37, 50
			C5	7
		4.2	C6	43
3.	SBdP	3.1	C5	6, 11, 36
			C6	13, 14
		4.1	C4	17, 30
			C5	33

			C6	8, 34, 40
4.	Civics	3.2	C4	23, 47
			C5	9, 10, 22, 25, 26, 45
		4.2	C5	49
5.	Indonesian	3.3	C4	19, 41
			C6	27
		4.3	C4	12, 32
			C6	44

Class		: V		
Theme		: 6 (Heat and Transfer)		
Subtema		: 1 (Temperature and Heat)		
No.	Lesson Content	KD	Indicator	Question Number
1.	IPA	3.6	C4	1, 2, 18, 38
			C5	6
			C6	4
		4.6	C4	3, 13, 27, 40, 41, 47, 48
			C5	43, 49
			C6	11, 12, 31, 33
2.	IPS	3.2	C4	8, 26, 28, 37
			C5	23, 45
		4.2	C4	29, 44
			C5	30, 39, 42, 46
			C6	5, 16
3.	SBdP	3.2	C4	14, 20
			C5	7
			C6	25
4.	Civics	3.2	C4	9, 17, 19, 33, 34, 35
			C5	22
		4.2	C6	10
			C5	50
5.	Indonesian	3.3	C4	15
			C5	36
		4.3	C4	21
			C5	24





Figure 2. Cover Bank Problem

#### 4. Design Validation

At this stage, an assessment of the product is carried out if it is seen from the rationality, later if it is used it will be effective or not if it is. It is rational if this validation is an assessment based on rational thinking, it is not in accordance with the facts in the field. Design validation is carried out by presenting several experienced experts to assess a new product being designed. (Sugiyono, 2017) This validation is carried out in 2 stages to determine the feasibility of the product being developed. Design validation was carried out by 3 validators, namely 2 evaluation experts, 2 material experts and 2 linguists (Widana, 2017). The validation results from the validator at the initial stage can be seen below:

Table 4. Results of the Product Validation Recapitulation that were developed in the first stage

No.	Validator	Percentage	Information
1.	Evaluation Expert	71.66%	Well worth it
2.	Material Expert	75.00%	Well worth it
3.	Linguist	75.55%	Well worth it
	Average	74.07%	Well worth it

Based on the table, the average percentage results indicate the feasible category, and received several suggestions from the validator to become the basis for revising the design.

#### 5. Design Revision

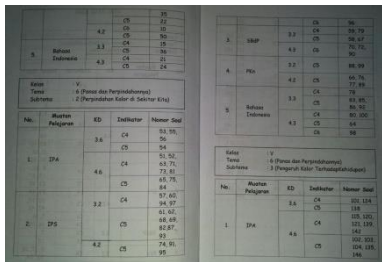
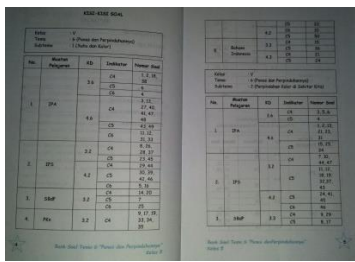
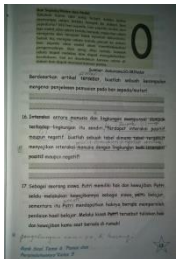
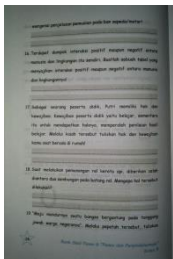
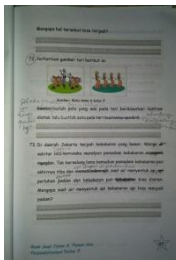
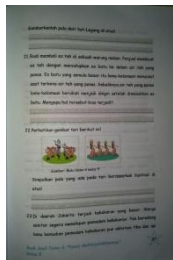
Assessment Theme 6, which contains HOTS (Higher Order Thinking Skills) assessment based on problem solving for class V SD / MI which has been validated by expert validators, the next step is to improve product design in accordance with the criticism and suggestions given by expert validators. The results of the validation by the validator provide information to researchers related to weaknesses in the assessment theme 6 that was developed. The results of the improvements and suggestions from the validator in the second stage can be seen below:

**Table 4.** The results of the product validation recapitulation were developed in the second phase

No.	Validator	Percentage	Information
1.	Evaluation Expert	83.84%	Very Worth it
2.	Material Expert	88.33%	Very Worth it
3.	Linguist	87.77%	Very Worth it
	Average	86.64	Very Worth it

Based on this table, the average percentage results indicate the category is very feasible, so that the product can be tested on students. The following shows the revised design results from the experts:

**Table 5** Design revision

	Before	After
		
		
		

## 6. Product Trials

Product trials by students, researchers also did in 2 madrasas, namely MI Darul Huda Bandar Lampung and MI Al-Fajar Pringsewu.

### a. Student Response

To find out the response of students, then a trial was conducted on 24 students at MI Darul Huda Pringsewu and 25 students at MI Al-Fajar Pringsewu. The results of the recapitulation of the students' responses are:

**Table 5.** Results of Student Response Recapitulation

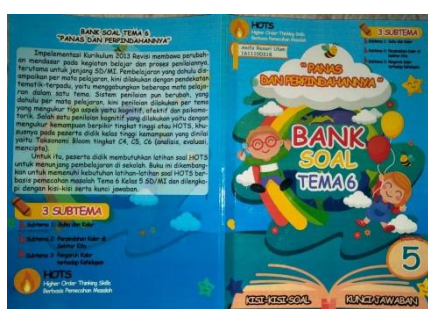
No.	Student Response	Percentage	Information
1.	MI Darul Huda Bandar Lampung	96.29%	Very interesting
2.	MI Al-Fajar Pringsewu	91.91%	Very interesting
	Average	94.01%	Very interesting

## 7. Product Revisions

Based on the results of these trials, it is known that the interest and response obtained from students is very high and very feasible. So it is not done and retried. Furthermore, the assessment developed can be used as a tool to train students in higher order thinking. At this stage the researcher revises the product cover as shown in the image below:



**Figure 3** Before the Revision



**Figure 4** After the Revision

## Discussion of Research Results

This research uses the research and development method Research and Development or R&D is a research method used in the manufacture of certain products as well as to test and try the effectiveness of the products produced (Sudaryono, 2018: 86). The development of HOTS (Higher Order Thinking Skills) Assessment Based on Problem Solving in Theme 6 Class V SD / MI with the final product as an assessment theme 6 has been tested and developed by researchers. The manufacturing process begins with compiling a question grid, creating

questions, creating answer keys and scoring guidelines in Microsoft Word Software. The front and back covers are designed using the Adobe Illustrator application. The assessment was printed on B5 JIS paper using Comic Sans CS font size 12.

Based on previous research, it is an integrated research of character building values. Where all these studies develop assessment in the form of multiple choice items and descriptions that differentiate between relevant research and the research that will be made and what will preserve the characteristics of this research is the HOTS Assessment which is based on problem solving. Then the questions are made in the form of essay items or descriptions. In this case what will be developed is on theme 6, namely heat and its displacement. Initial product design validation was carried out by 2 expert evaluation validators, 2 material expert validators, and 2 linguist validators. Product design validation is carried out to assess the products developed by researchers. The results of the evaluation expert's validation analysis show that the content feasibility aspect gets a percentage of 84,83.84% with very decent category. So that the HOTS question of this study has a high category. The reliability of HOTS questions in this study has a "high" category (Jihad & Haris, 2013). Validation of material experts is known that in the aspect of conformity of material with KI and KD, it gets a percentage score of 83.33% with a very decent category, the accuracy of the material with a percentage score of 88% is very feasible, the updating of the material gets a percentage of 100% with a very decent category, and encourages curiosity obtained a percentage of as much as 85% in the very feasible category. Based on the percentage score, the average percentage is 88.33% with the very feasible category. The arrangement should explain and make it easier to understand the reading text. Therefore the selection of images must support the content of the text. The material has several conditions,

Validation of linguists is known that the aspect of straightforwardness gets a percentage of 86.66% with a very decent category, communicative gets a percentage of 100% with the very feasible category, dialogic and interactive get a percentage of 90% with a very feasible category, the suitability of the development of students gets a percentage of 80% with the category feasible, and conformance with language rules gets a percentage of 90% with very feasible category. From this percentage score, the average percentage is 87.77% with very decent category. As said by Prastowo, teaching materials are arranged systematically in language that is easily understood by students according to their level of knowledge and age so that they can learn on their own (independently) with minimal assistance or guidance from the teacher (Andi Prastowo, 2014).

The results of the analysis conducted by researchers on the assessment of the response of educators at MI Darul Huda Bandar Lampung on the aspect of content feasibility obtained a percentage of 100% with a very feasible category, presentation with a percentage of 97.5%, very feasible categories, and aspects of language eligibility obtained a percentage of 95% with a very category. worth it. Based on the percentage score, it is known that the average percentage of 97.14% is very feasible. Whereas in the results of the analysis of the results of the MI Al-Fajar Pringsewu educator's assessment on the aspect of content feasibility, it got a percentage of 90% with the very feasible category, the presentation got a percentage of 95% with the very feasible category, and the language feasibility aspect got a percentage of 100% with the very

feasible category. The average percentage based on the percentage score obtained is 95, 71% with very feasible category. Based on the fairly high assessment results, there was no revision and retry of the theme 6 assessment developed.

The results of trials related to students' responses were carried out in two stages, namely small-scale trials and large-scale trials. Small-scale and large-scale trials were carried out in two madrasas, namely MI Darul Huda Bandar Lampung and MI Al-Fajar Pringsewu. The results of the small-scale trial at MI Darul Huda Bandar Lampung obtained an average percentage of 99.33% with the very feasible category, then on the small-scale trial at MI Al-Fajar Pringsewu obtained an average percentage of 96.66% with the category very worthy. In the large-scale trial at MI Darul Huda Bandar Lampung, an average percentage of 96.29% was obtained with the very feasible category, while in the large-scale trial at MI Al Fajar Pringsewu obtained an average percentage of 91.91% in the very category. worth it. This is in accordance with what Nieveen stated, the aspect of effectiveness is fulfilled if the results of using the product produce the expected achievements (Sannah et al, 2015). In line with what Prasetyo stated, the effectiveness is measured based on classical student learning completeness on the condition that students who complete the number are greater than or equal to 85% (Sannah et al, 2015).

## CONCLUSION

Research and development of assessment theme 6 as a tool to assist students in training higher order thinking skills. As for the conclusions from the research and development results of the theme 6 assessment, HOTS assessment development is carried out by making HOTS questions starting from the analysis of Basic Competencies and Core Competencies, then making a question grid, then making an interesting stimulus, writing questions and the last one is making answer key to the question. Assessment theme 6 developed "Very Feasible" to be used as a tool to train students in higher order thinking. This was obtained based on product validation by evaluation experts, material experts and linguists. The results of the evaluation expert's assessment reached the "Very Appropriate" category with a percentage of 83.84%. The results of the assessment of the material experts reached the "Very Appropriate" category with a percentage of 88.33%. The results of the assessment of linguists were 87.77%.

The response of educators at MI Darul Huda Bandar Lampung to the assessment developed by researchers got a percentage of 97.14% with the "very feasible" category, then at MI Al-Fajar Pringsewu got a percentage of 95.71% with the criteria "very feasible." While the response and assessment of students at MI Darul Huda Bandar Lampung and MI Al-Fajar Pringsewu, the assessment developed by researchers both in small-scale trials consisting of 10 students had a percentage of 99.33% in MI Darul Huda Bandar Lampung, while in MI Al-Fajar Pringsewu received a percentage of 96.66%. Then in a large-scale trial involving 24 students at MI Darul Huda Bandar Lampung with a percentage acquisition of 96.29%, and at MI Al-Fajar Pringsewu with a total of 25 students getting a percentage of 91.91%.

In the product trial, it was rated "Very Interesting". This shows that the assessment developed is very feasible and interesting and can be used as a tool to train students in higher-order thinking or HOTS.

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