Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.13, No.16, 2022

Development of HOTS-Based Student Activity Sheet with an Open Ended Approach to Improve Mathematical Metacognition Ability and Self Confidence of Students of 20 Medan Junior High School

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Abstract
This study aims to describe: 1) how the quality of HOTS-based student activity sheet with an *Open Ended* approach is quality; 2) increasing students' mathematical metacognition skills through HOTS-based worksheets with an *Open Ended* approach; and 3) increasing students' *self confidence* through HOTS-based worksheets with an *Open Ended* approach. This research is a development research. This research was conducted in two stages, namely the first stage of developing HOTS-based worksheets with an *Open Ended* approach using a *formative evaluation* type Tessmer development model, and the second stage testing HOTS-based worksheets with an *Open Ended* approach which was developed in class VIII-1 and VIII-3 SMP. State 20 Medan. From the results of trial I and trial II, it was obtained: 1) HOTS-based worksheets with an *Open Ended* approach to improve students' mathematical metacognition and *self confidence* skills that have been developed have met the valid, practical and effective criteria; 2) Increasing the ability of mathematical metacognition using HOTS-based worksheets with the *Open Ended* approach which has been developed as seen from the N-gain value in the first trial of 0.43 which increased to 0.47 in the second trial, meaning that it is in the "moderate" category; and 3) The increase in students' *self confidence* with the *Open Ended* approach which has been developed as seen from the N-gain value in the first trial of 0.46 increased to 0.51 in the second trial, meaning that it is in the "medium" category.
Keywords: development LKPD, Tessmer model, *Open Ended* Approach, HOTS, Mathematical Metacognition, *Self Confidence*.
DOI: 10.7176/JEP/13-16-06
Publication date: June 30th 2022

1. Introduction

Mathematics is one of the main subjects in every level of education. According to Hasratuddin (2018), mathematics is a tool used to develop and grow the ability to think logically, think critically, and systematically in a person. Cockcroft (1982) argues that mathematics needs to be taught to students because: (1) Always apply mathematics to all aspects of life; (2) All fields of study require appropriate mathematical skills; (3) Strong, concise and clear communication methods; (4) Can be used to present information in various ways; (5) The ability to think logically, thoroughness, and spatial awareness; and (6) Expressing satisfaction with efforts to solve challenging problems. Cornelius (1982) also expresses the same view, he shows that five reasons it is necessary to study mathematics for mathematics are (1) a clear and logical way of thinking; (2) How to solve daily life problems; (3) How to identify patterns of relationships and generalize experiences; (4) How to develop creativity; (5) Means to increase awareness of cultural development.

According to Simamora, R. E., Saragih, S., & Hasratuddin (2018), that “The current vision of mathematics education is to master the concepts used in learning mathematics, which are used to solve problems. Meanwhile, the vision of future mathematics education is to provide opportunities for the development of thinking, self-confidence, beauty, objectivity and openness. Considering the important role of mathematics in other disciplines, students' mathematics learning achievement needs to be improved. This work can be done well if there is a desire from the students themselves. The objectives of learning mathematics in Permendikbud (2014) are (1) Understanding mathematical concepts, solving problems in a flexible, accurate, efficient and precise way, explaining the relationship between concepts or algorithms; (2) Reasoning about patterns and the nature of generalizing, constructing proofs or explaining mathematical operations of mathematical thoughts and statements; (3) Problem solving, including the ability to understand problems, design, mathematical models, solve models and explain the solutions obtained; (4) Communicating ideas with symbols, tables, diagrams or other media to clarify situations or problems (5) Having an attitude of appreciating the use of mathematics in life, namely having curiosity, attention, interest in learning mathematics, flexible attitude and confidence in solving problems. Based on these goals and the importance of mathematics in human life, the government has worked hard to improve the quality of mathematics education. This can be seen from the various efforts made by the

government such as curriculum improvements, teacher capacity building and various other efforts aimed at producing quality intelligence and human resources.

Many factors affect the low quality of education in Indonesia. One of them is the learning process which has not been maximized and the influence of the learning media and methods used is not good. The 2006 curriculum, namely the Education Unit Level Curriculum (KTSP) (Permendiknas No. 22, 23, and 24 of 2006) contains Graduate Competency Standards (SKL) and Content Standards (SI). Both SKL and SI prioritize student competence. In accordance with the demands of the KTSP curriculum, teachers act as facilitators in the learning process and have the ability to manage and develop teaching materials as learning resources. This is further strengthened by Government Regulation Number 19 of 2005 Article 20 which stipulates that in carrying out professional duties, one of the duties of teachers is to plan lessons, organize quality learning processes, and evaluate learning outcomes. To meet these needs, of course, efforts need to be made to improve the quality both in terms of supporting educators, educational facilities, learning tools and government policies that meet the needs of the education sector.

One of the abilities that must be possessed by students in learning mathematics is the ability of mathematical metacognition. This is in accordance with the five aspects of mathematical ability as formulated by the National Council of Teachers of Mathematics (NCTM) (2000) including: "(1) mathematical communication; (2) mathematical reasoning (mathematical reasoning); (3) mathematical problem solving (mathematical problem solving); (4) mathematical connection (mathematical connection); and (5) mathematical representation". The benefit of metacognition according to Marzano (1998), for teachers and students is to emphasize self-monitoring and student responsibility. Students can self-regulate by planning, directing and evaluating. A student who already has a metacognitive strategy will more quickly become an independent learner. According to Susantini (2004), through metacognition students are able to become independent learners, foster an honest attitude, dare to admit mistakes, and can improve learning outcomes significantly.

In fact, the results of observations made at SMP Negeri 20 Medan show that students' mathematical metacognition abilities are low. This is evidenced when the researcher conducts an initial test to class VIII-1 students that in these answers students are able to write down what they know, but have not written down what the questions are asking, because students cannot compile information from the questions to change it in the model. mathematics, because students do not know the formula used in the problem so that students are confused in carrying out the completion steps, and are less careful in calculating the answers to the questions, then the habit of students after completing the answers does not re-examine the results obtained and do not draw conclusions on question.

Based on the results of student answers obtained, namely from 32 students who were given this question, when viewed from the guidelines for scoring mathematical metacognition abilities in planning aspects with written indicators that were known, asked correctly and completely there was only 1 person, wrote down what was known and asked with 2 people were correct but incomplete, wrote down what was known and asked by 5 people, did not write down what was known and asked by 8 people, and 16 people did not give an answer at all.

From the explanation above, it is known that each step of completing the mathematical metacognition ability test of students is categorized in low ability, because most students get the lowest score on each indicator of mathematical metacognition ability. All students are categorized as having low mathematical metacognition abilities with a value of <59. Referring to the classification of students' abilities according to Arikunto (2006) if $N \geq 88$ is in the "high" ability category, $59 \leq N < 88$ is in the "medium" ability category and $N < 59$ is in the "low" ability category. Overall, it can be concluded that students' mathematical metacognition skills are still low, as can be seen from the results of learning mathematics, so teachers can make efforts to improve mathematical metacognition abilities. Efforts were made by providing a self-confidence questionnaire sheet to find out the extent of students' confidence in understanding the material provided.

In addition to cognitive aspects, affective aspects are also important in mathematics. One of these abilities is students' self-confidence. Self confidence is related to mathematical metacognition abilities, with self confidence students with low abilities will still actively learn with mathematical metacognition processes and make these students more able to solve standard problems than students who do not master mathematical metacognition abilities. Self confidence makes students more independent as learners.

According to Lestari and Yudhanegara (2015: 95) self-confidence is an attitude of being confident in one's own abilities and seeing oneself as a complete person. Self confidence plays a very important role in learning, according to Nurkholifa, S. Toheri, & Winarso, W (2018: 59) say that self-confidence is important to actualize the potential possessed by students and with self-confidence, students will be more motivated and prefer to learn mathematics. Zamnah, N.L. and Ruswana, M.A. (2018: 53) said Self-confidence is an important element in achieving success. According to Fitriani (2014: 89) if someone has high self-confidence, then he will always try to develop everything that becomes his potential.

The need for self-confidence that students have in learning mathematics is apparently not accompanied by existing facts, according to the results of the researcher's interview with Mrs. Ira Yusma as one of the

mathematics teachers at SMP Negeri 20 Medan, she said that there are still many students who do not have self-confidence, This can be seen in several student behaviors in learning where students are not confident to ask questions when experiencing difficulties, do not dare to express opinions in front of the class, or in discussions so that they do not play an active role in learning, and students tend to be passive in learning. Based on the results of the 2015 Third International Mathematics And Science Study (TIMSS), it shows that the self-confidence of Indonesian students is on a scale of 23% related to the mathematical abilities of students. The percentage is relatively low compared to other countries. Based on this fact, it is concluded that the level of student self-confidence is still low.

Apart from understanding mathematical metacognition and low self-confidence of students, one of the causes of low student learning outcomes is the learning approach used by the teacher is still said to be an ordinary or conventional learning approach. In accordance with the results of the researcher's interview with one of the mathematics teachers of SMP Negeri 20 Medan on Wednesday, June 23, 2021, he said that learning activities took place as usual, the teacher explained the material and students listened to the teacher's explanation, followed by giving practice questions. Learning activities cannot be carried out in accordance with the existing RPP, the most important thing is that the explanation of the material reaches students and students can absorb the knowledge given by the teacher.

To address the problems that occur in the field in the process of learning mathematics at school, especially in the ability of mathematical metacognition and self-confidence of students which results in low mathematics learning outcomes, teachers must make efforts to improve these conditions. Efforts have been made, including improving the Student Worksheet (LKPD).

The Student Worksheet (LKPD) is defined as a printed teaching material in the form of sheets of paper containing material, summaries, and instructions for implementing learning tasks that must be done by students with reference to the Basic Competencies (KD) that must be achieved (Andi Prastowo , 2012: 204). The Student Worksheet (Student Activity Sheet) is one of the things that affects the success of education and is also a factor that must be considered by a teacher and should be owned by every teacher.

By using student activity sheet, it will open up opportunities for students to be active and creative in the learning process and as a learning medium in which there are several practice questions. This can familiarize students to practice their learning abilities independently. With the student activity sheet the teacher is also helped in the learning process which sometimes takes a long time to explain the material to be conveyed in the teaching and learning process.

Developing Student Worksheets (Student Activity Sheet) is a teacher's effort in realizing learning preparation before learning is carried out. The purpose of designing Student Worksheets (Student Activity Sheet) is to prepare sheets containing tasks that must be done by students, usually in the form of instructions, steps to complete a task by referring to the Basic Competencies (KD) to be achieved. To get a good teaching and learning process, good learning planning is also needed. This statement is in line with Hariyanto (2013: 02), namely: "The success of an activity is largely determined by its planning, if the planning of an activity is well designed, then the activity will be easier to carry out, directed and controlled".

Therefore, education in Indonesia requires practice of high-level thinking questions (HOTS) to be able to familiarize students with solving problems on these questions and improve students' higher-order thinking skills (Rahayu, et al., 2018). Efforts to improve students' high mathematical thinking skills and develop student activity sheet require an appropriate learning approach as well. The learning in this research is learning with an Open Ended approach.

Shimada (Alhadad, 2010:19) Open Ended approach starts from the view of how to evaluate students' abilities objectively in high-level mathematical thinking. This approach begins by involving students in open problems that are formulated to have several incomplete or open correct answers.

Meanwhile, Firdaus (2016: 228) said that the purpose of learning with the Open Ended approach is to help develop the creative activities of students and their mathematical thinking skills in solving problems. In addition, with this approach, each student is expected to have the freedom to solve problems according to their abilities and interests. Students with higher abilities can perform various mathematical activities and students with lower abilities can still enjoy mathematical activities according to their own abilities.

Related to this kind of learning approach, it is hoped that it can provide freedom of thought for students in solving given problems, so as to improve students' mathematical metacognition abilities. One option for learning mathematics that can meet these expectations is learning with an Open Ended approach.

The Open Ended approach is a learning approach that presents a problem that has more than one correct solution or final answer. In line with the opinion of Becker (Oktaviani, et al., 2017:135) This approach provides opportunities for students to gain knowledge and experience finding, recognizing, and solving problems with several techniques. This learning is very in line with the constructivist view, where students can construct their own knowledge based on investigations of problems and elaborate them with prior knowledge.

Based on previous research, such as Purwanto's research (2011) suggests that learning exponential function

graphs with the Open Ended approach can improve students' creative attitudes, based on this that learning with the Open Ended approach improves students' mathematical metacognition abilities.

Therefore, the Open Ended approach provides opportunities for students to learn through real activities by presenting natural phenomena as open as possible to students. This open form of presenting phenomena can be done through problem-oriented learning or open-ended questions. Conceptually, open problems in mathematics learning are problems or mathematical problems that are designed in such a way, so that they have several or even many correct solutions and many ways to reach that solution.

Based on the description above, it is related to the problems that cause students' mathematical metacognition ability and self-confidence to be low. Then research will be carried out to find solutions to existing problems by developing teaching materials. This is what prompted him to conduct a research entitled "Development of HOTS-Based Student Activity Sheet with an Open Ended Approach to Improve Mathematical Metacognition and Self-Confidence Skills of Students at 20 Medan Junior high school ".

2. Research methods

Types of research

This research is a development research that is used to produce certain products and test the effectiveness of these products. To develop and validate the product, it is combined using a formative evaluation type Tessmer development model, which consists of 2 development stages, namely preliminary (determination) and prototyping (design and evaluation).

Research Subjects and Objects

The subjects in this study were students of class VIII-1 of SMP Negeri 20 Medan for the academic year 2021/2022, and the object of this study was the HOTS-based Student Activity Sheet for SMP class VIII using an open-ended approach that was developed.

Data analysis

Data Analysis of Learning Device Validity

This validation is based on the opinion of five experts and practitioners in the field of education. Based on the expert opinion, the average value for each aspect will be calculated so that the average value for the total aspect is obtained.

Data Analysis of Practicality of Learning Devices

Kriteria kepraktisan dengan melihat pendapat atau respon dari ahli yang menyatakan bahwa learning tools using the open-ended learning model are that they can be used with little or no revision. The way to give an opinion about the practicality of this learning device is to provide a learning device assessment scale along with a learning device validation sheet in accordance with the open-ended learning model.

Implementation of learning devices, provided observation sheets (observations) during the learning takes place. The implementation of the learning activity steps is observed by an observer who has been directed previously so that he can operate the learning implementation observation sheet correctly. The observation sheet on the implementation of learning devices is made in the form of choices with a score of 1 to 5, with the provisions of a score of 5 (very good), a score of 4 (good), a score of 3 (good enough), a score of 2 (not good), and a score of 1 (not good).).

Data Analysis of Learning Device Effectiveness

Data on the effectiveness of the learning tools developed were analyzed from: (1) data on student learning mastery, (2) achievement of learning objectives, and (3) student responses. For the effectiveness of learning tools related to mathematical metacognition abilities, it is determined based on the achievement of classical student learning mastery. Minimum completeness is analyzed by considering that students can be said to be complete if the individual student scores reach a score of 80. This 80 is the value of Minimum Completeness Criteria (KKM) for class X at SMA Negeri 1 Singkil. Furthermore, a lesson is said to have been completed classically, that is, at least 85% of students who take the test have achieved a score of 80. Percentage of Classical Completeness (PKK) 85%.

Data Collection Instruments and Techniques

Learning Tool Validation Instruments

The learning device validation instrument is a learning device validation sheet that is used to obtain data about the quality of learning tools based on the assessment of experts. Validation sheet for RPP, and Student Activity Sheet (Student Activity Sheet). This validation sheet contains the components that are assessed including: format, language, illustrations, and content.

Mathematical Metacognition Ability Test Instruments

The test instrument for mathematical metacognition is in the form of a structured description test.

Student Response Instrument

The instrument for student responses is a student response questionnaire which is an opinion or student response to the components and learning tools developed. The technique used to obtain student response data is carried

out by distributing questionnaires to students. Student responses in this study are student opinions on interest, feelings of pleasure, currentness, interest, and ease of understanding learning materials through learning tools developed through the Open Ended learning model.

Learning Media Development Procedure

Determination Stage (Preliminary)

This preliminary stage is the stage of determining the place and research subject. The initial stage of this model is to identify learning objectives. The goal is to determine the expected competencies so that they can be mastered and carried out by students after completing learning. This goal is determined from the analysis of the implementation of learning, from the tests given, and from the various learning difficulties of students.

Self Evaluation

This stage is the initial step of development research. At this stage, a preliminary analysis is carried out including an analysis of students where the target students are students in grades VIII-1 and VIII-3, curriculum analysis shows the identification and systematic arrangement of concepts in the cube and block material which becomes a concept map, and analysis of the materials used. will be developed, namely HOTS-based Student Activity Sheet.

Prototyping

The results of the design on the first prototype developed on the basis of self-confidence are given to experts (expert review) and students (one-to-one) in parallel. The results of both are used as material for revision. The result of the revision of the first prototype is called the second prototype.

Expert Review

At the expert review stage, an examination of the designed product was carried out, assessment and evaluation by 7 experts consisting of 3 mathematics education lecturers, 2 colleagues, and 2 mathematics study teachers. These experts examine the content, construct, and language of each prototype. Expert suggestions are used to revise the material developed. At this stage, responses and suggestions from experts (validators) about the designs that have been made are written on the validation sheet as revision material and state whether this design is valid or not.

One-to-one

In the one-to-one stage, a design trial was carried out with 6 students who became testers and were divided into 3 categories, namely 2 students with low abilities, 2 students with moderate abilities, and 2 students with high abilities. . The results of this implementation are used to revise the design that has been made.

Small group

The results of the revision from the expert review and the difficulties experienced during testing on the first prototype were used as the basis for revising the prototype and called the second prototype, which was then tested on a small group consisting of 9 students with 3 categories, namely 3 students with low abilities. , 3 students with moderate ability, and 3 students with high ability. The results from the implementation of this trial are then used for revision before the trial is carried out at the field test stage. After revision of the questions based on the suggestions or comments of students in the small group, the results of the analysis of these items are called the third prototype.

Field test

The suggestions and test results on the second prototype are used as the basis for revising the second prototype design. The results of the next revision were tested on research subjects. The trial in this case is a field test or field test. Products that have been tested in the field test must be products that have met the quality criteria.

Validation/Expert assessment (Expert Appraisal)

In this activity an evaluation is carried out by experts in their fields. Expert validation is a technique to get suggestions for improvement as well as an assessment of the learning tools that have been produced at the design stage. The learning tools in question are all materials that have been developed at the design stage.

Trial of Research Instruments

The research instrument used in this study was a test of students' metacognitive abilities and self-confidence in mathematics. Before using the research instrument, the research instrument was first tested in a class outside the sample. Furthermore, validity and reliability tests were carried out. The purpose of this stage is to produce a good research instrument, in the sense that it is valid and feasible to use during field trials.

Field Trial

Field trials were conducted to obtain direct input on the learning tools that have been developed so as to produce the final tools. The learning tools were tested in schools to see the practicality and effectiveness of the learning tools that have been designed to increase students' metacognitive abilities and mathematical self-confidence.

Stage of Dissemination

This activity was carried out in a limited manner in the discussion forum for mathematics subject teachers at SMP Negeri 20 Medan. The result of this stage is to recommend to all mathematics subject teachers at SMP Negeri 20 Medan to use this device as an alternative learning on Cube and Block material.

3. Research result

Validation of Learning Tools by Using Open Ended Learning Tools by Using Developed Tools

The research instrument used in this study was a mathematical metacognition ability test. Before using the research instrument, the research instrument was first tested on a class outside the sample, then the validity and reliability were tested. The goal is to produce a good research instrument, in the sense that it is valid and usable. The results of the validity and reliability test of the instrument are described as follows:

The validity of the questions was analyzed using the product moment person correlation formula, namely by correlating the score of the item with the total score. The test results of the students' mathematical metacognition ability test instruments are presented in Table 1. below.

Table 1. Validity of Posttest Items for Mathematical Metacognition Ability

Test Items	r_{xy}	t_{count}	t_{table}	Interpretation
1	0,9169	9,746	0,444	Valid
2	0,8661	7,351	0,444	Valid
3	0,9382	11,501	0,444	Valid
4	0,865	7,313	0,444	Valid

Based on the results of the validation of experts and practitioners on the it meets the valid category. So that the learning device can be used with minor revisions in accordance with the advice given by the experts. The recapitulation of the validation results carried out by the five validators can be concluded in table 2 below:

Table 2. Learning Tool Validation Results

No.	Rated object	Average Value of Total Validity (V_i)	Category
1	Learning Implementation Plan	4,320	Valid
2	Student Activity Sheet	4,20	Valid

Student Activity Sheet Effectiveness by Using Metacognition Ability and Self Confidence Through an Open-ended Learning Approach

Student Activity Sheet and HOTS-based test instruments with an open ended approach will be appropriate to use if they can have a positive impact or significant influence on learning. Student Activity Sheet and HOTS-based test instruments that are developed must meet the effectiveness criteria, namely: (1) achievement of learning mastery (if it has a minimum absorption capacity of 75%, while classical completeness is achieved if 80% of students have passed), (2) achievement of learning objectives mastery (a minimum of 75% of the formulated learning objectives can be achieved by a minimum of 65% of students); and (3) students' responses to learning are positive. In the following, a discussion will be presented for each indicator in measuring the effectiveness of Student Activity Sheet and HOTS-based test instruments with the Open Ended trial approach I.

The results of metacognition ability that there are 9 students who have mathematical metacognition ability with very high criteria in the pretest, but in the posttest there are 17 students with very high criteria. There are 8 students who have mathematical metacognition skills with high criteria on the pretest results and there are 10 students with high criteria on the posttest results. There are 11 students who have mathematical metacognition skills with moderate criteria on the pretest results and there are 5 students with moderate criteria on the posttest results. There are 4 students who have mathematical metacognition skills with low criteria on the pretest results but in the posttest there are no students with low criteria. While the results of the pretest and posttest there are no students who have mathematical metacognition abilities with very low criteria. That the number of students who completed the pretest were 16 students or 50% and at the posttest 24 students or 75%. Based on the effectiveness criteria, classical completeness must be 75%, meaning that the results of the students' classical mastery test in the first trial have not been effective.

In this study, students' self-confidence questionnaire data were obtained from pretest and posttest data. The self-confidence questionnaire is carried out once at the beginning before the learning activity begins which is called the pretest and once at the end of the lesson called the posttest. The provision of pretest and posttest aims to determine the increase in the self-confidence ability obtained by students after being given learning treatment using open-ended approach-based learning on the flat-sided building material. in the high, medium, poor and low categories respectively, namely: (7, 21, 4, 0) while in the posttest the number of students who are in the high, medium, poor and low categories respectively are: (25, 6, 1, 0). that the percentage of students' self-confidence questionnaire results in the first trial pretest, namely in the high, medium, less and low categories (21.9%, 65.6%, 12.5%, 0%) while the percentage of students' self-confidence questionnaires in the posttset trial I of (78.2%, 18.7%, 3.1%,0%).

Student activity sheet and HOTS-based test instruments with an open ended approach will be appropriate to use if they can have a positive impact or significant influence on learning. Student activity sheet and HOTS-based test instruments that are developed must meet the effectiveness criteria, namely: (1) achievement of learning mastery (if it has a minimum absorption capacity of 75%, while classical completeness is achieved if 80% of students have passed), (2) achievement of learning objectives mastery (a minimum of 75% of the

formulated learning objectives can be achieved by a minimum of 65% of students); and (3) students' responses to learning are positive. In the following, a discussion will be presented for each indicator in measuring the effectiveness of the student activity sheet and the HOTS-based test instrument with the Open Ended trial approach II. That the number of students who completed the pretest was 13 students or 40.62% and at the posttest 23 students or 76.66%. Based on the effectiveness criteria, classical completeness must be 75%, meaning that the students' classical mastery test results in the second trial have been effective or have been achieved for all indicators. Thus, the post-test results in the second field trial have met the criteria for achieving learning objectives.

Student self-confidence questionnaire data was obtained from pretest and posttest data. The self-confidence questionnaire is carried out once at the beginning before the learning activity begins which is called the pretest and once at the end of the lesson called the posttest. Giving pretest and posttest aims to determine the increase in the ability of self-confidence obtained by students after being given learning treatment using an open-ended approach-based learning on flat-sided building material. The description of the results of students' self-confidence in the second trial is shown in the percentage of the students' self-confidence questionnaire results in the pretest of the second trial, namely in the high, medium, less and low categories (40.7%, 59.3%, 0%, 0%) while the percentage of students' self-confidence questionnaires in the post-test test I was (81.3%, 18.7%, 0%, 0%). In the second trial, the effectiveness of the student activity sheet with the Open Ended Approach that was developed has met all the effective criteria set by the effectiveness indicators that were met in the second trial.

Thus, it is known that the achievement of learning time using student activity sheet in open-ended learning in trial II is the same as the usual learning time carried out so far, namely six meetings with basic competencies: (1) explaining the properties of cubes and blocks (2) Solving problems related to cubes and blocks in open ended. This is in accordance with the learning time criteria, namely the achievement of the minimum learning time is the same as ordinary learning, thus the achievement of the second trial learning time has been achieved. Based on the results of the second trial data analysis, it is known that the learning tools developed have been effective.

Improving Students' Metacognitive Ability

The analysis of increasing students' mathematical metacognition abilities in the first trial will be seen through the N-Gain from the results of the pretest and posttest of students' mathematical metacognition abilities in the first trial. The results of the N-Gain calculation on mathematical metacognition abilities can be seen in the following table:

Table 3. Summary of N-Gain Results of Mathematical Metacognition Ability Trial I

N-Gain	Interpretation	Total students
$g \leq 0,3$	Low	10
$0,3 < g \leq 0,7$	Medium	19
$g > 0,7$	Hight	3

Based on Table 4.25 above, it can be seen that there are 3 students who got an N-Gain score in the range > 0.7 in the high category. Students who experienced an increase in their mathematical metacognition ability in the Medium category or got an N-Gain score of 0.3 <g≤0.7 as many as 19 students and students who experienced an increase in their mathematical metacognition ability in the low category or got an N-Gain score of g≤0.3 as many as 10 students. So, the average in the first trial was 0.43 in the "medium" category. The values of N-Gain indicators of mathematical metacognition ability are 0.619; 0.373 and 0.266. The indicator that has the lowest increase is the third indicator with an N-Gain value of 0.266, namely evaluation, while the indicator that has the highest increase is the first indicator with an N-Gain value of 0.619, namely planning problems.

The analysis of increasing students' mathematical metacognition abilities in the second trial will be seen through the N-Gain from the results of the pretest and posttest of students' mathematical metacognitive abilities in the second trial. The results of the summary of N-Gain mathematical metacognitive abilities can be seen in Table 4. below:

Table 4. Summary of N-Gain Results of Experimental Mathematical Metacognitive Ability II

N-Gain	Interpretation	Total students
$g \leq 0,3$	Low	10
$0,3 < g \leq 0,7$	Medium	17
$g > 0,7$	Hight	5

The increase in Self Confidence in trial 1 will be seen through the N-Gain from the results of the pre-test and post-test of the Self Confidence questionnaire in the first trial. The results of the N-Gain calculation are presented in Table 5 below

Table 5 Results of N-Gain Self Confidence Trial 1

N-Gain	Interpretation	Total students
$g > 0,7$	Low	8
$0,3 < g \leq 0,7$	Medium	16
$g \leq 0,3$	Hight	8

The average N-Gain value is 0.464 if it is interpreted into the classification described in Chapter III, then the total increase in Self confidence in the first trial obtained is in the "medium" category or with a Gain percentage of 46%. it can be seen that 8 students got an N-Gain score in the range > 0.7 or experienced an increase in self-confidence in the "High" category. For students who experienced an increase in Self confidence with the "Medium" category or got an N-Gain score of 0.3 < g 0.7, there were 16 students and 8 students who got an N-Gain score g 0.3 or experienced an increase in Self confidence with "Low" category.

The increase in self confidence in the second trial will be seen through the N-Gain from the results of the pretest and posttest Self confidence questionnaires in the second trial. The results of the N-Gain calculation are presented in Table 6 below:

Table 6 Results of N-Gain Self Confidence Trial II

N-Gain	Interpretation	Total students
$g > 0,7$	Low	9
$0,3 < g \leq 0,7$	Medium	17
$g \leq 0,3$	Hight	6

The average N-Gain value is 0.51 if interpreted into the classification described in Chapter III, then the total increase in Self-confidence in the first trial obtained is in the "medium" category or with a Gain percentage of 51%.

Based on the table above, it can be seen that 9 students got an N-Gain score in the range > 0.7 or experienced an increase in self-confidence in the "High" category. For students who experienced an increase in self-confidence in the "medium" category or got an N-Gain score of 0.3 < g 0.7, there were 17 students and 6 students who got an N-Gain score g 0.3 or experienced an increase in Self confidence with "Low" category

4. Discussion

Improved Mathematical Metacognition Kemampuan

Based on the results of the posttest analysis of mathematical metacognitive abilities in the first and second trials, it showed that there was an increase in mathematical metacognition abilities. The increase in students' mathematical metacognitive abilities can be seen from the average results of the pretest and posttest mathematical metacognition abilities obtained by students.

The results of the analysis of increasing students' mathematical metacognition abilities on the pretest and posttest results showed that the average mathematical metacognition ability in the first trial was 62.89, increasing to 77.93. In the second trial, there was an increase in the average value of students' mathematical metacognition abilities of 57.94, increasing to 76.76. In addition, the average of each indicator of students' mathematical metacognition ability increased from trial I to trial II. This shows that the use of student activity sheet with the Open Ended approach that was developed has an impact on increasing students' mathematical metacognition abilities.

The Ministry of National Education (Sofnidar, 2017: 59) suggests that the purpose of contextual learning is to help students understand the meaning of the subject matter they are studying by relating the material to the context of their daily lives (personal, social and cultural contexts), so that students have knowledge/skills that are flexible can be applied (transferred) from one problem/context to another problem/context.

In addition, the problem/learning context emphasizes the active involvement of students to be able to find the material being studied and relate it to real-life situations both in the family, community, and other activities. Such a learning process has a positive impact on the development of mathematical reasoning abilities and helps students develop intellectual discipline and skill needs to increase curiosity and seek answers to their curiosity.

In the Open Ended approach students are expected to be able to reason about the things they understand and what is in their minds to build the knowledge gained. This is because if reasoning abilities are not developed in students, then for students mathematics will only be material that follows a series of procedures and imitates examples without knowing their meaning. Thus, learning with an open-ended approach is able to improve students' mathematical metacognition abilities. This is reinforced by the research of Lestari, Selvia, and Layliyah (2019) which states that the Open Ended approach is one alternative that teachers can choose to improve students' mathematical metacognition abilities. This is also supported by the research of Zakiah Nur Eva (2014) which states that through learning with an Open Ended approach, it can improve students' mathematical metacognition and Mathematical Habits of Mind for junior high school students. The increase in mathematical metacognition abilities was obtained due to: (1) Learning Implementation Plans which were prepared easy to

understand and easy to use by teachers and students in the learning process; (2) The steps with the Open Ended approach are easy for teachers to implement; (3) The student worksheets (Student Activity Sheet) that are prepared are easy for students to understand because the instructions given are clear, the writing is easy to read, and the pictures and tables used are easy to understand and interesting; (4) The questions and statements on the students' mathematical metacognition ability test are unambiguous (having more than one meaning) and the instructions for processing are easy to understand.

Increasing Student Self Confidence

Based on the results of the pretest and posttest analysis of the self confidence questionnaire in the first trial and second trial, it was shown that there was an increase in the students' self confidence questionnaire. This increase can be seen from the average pretest and posttest results on the students' self-confidence questionnaire.

The results of the analysis of increasing student self-confidence in the results of the pretest and posttest showed that the average self-confidence in the first trial of 0.464 obtained was in the "medium" category or with a gain percentage of 46%. In the first trial, it was seen that 8 students got an N-Gain score in the range > 0.7 or experienced an increase in self-confidence in the "High" category. For students who experienced an increase in Self-Confidence in the "Medium" category or got an N-Gain score of 0.3 < g 0.7, there were 16 students and 8 students who got an N-Gain score g 0.3 or experienced an increase in self-confidence. with the "Low" category.

In the results of the increase in the second trial analysis of the student's self-confidence questionnaire, it showed that the average self-confidence of 0.506 obtained was in the "medium" category or with a 50% gain percentage. In this second trial, it can be seen that 9 students got N-Gain scores in the range > 0.7 or experienced an increase in self-confidence in the "High" category. For students who experienced an increase in self-confidence in the "medium" category or got an N-Gain score of 0.3 < g 0.7, there were 17 students and 6 students who got an N-Gain score g 0.3 or experienced an increase in Self confidence with "Low" category.

According to Anthony (1992) self-confidence is an attitude in a person who can accept reality, can develop self-awareness, think positively, have independence and have the ability to have and achieve everything he wants. So that students have self-confidence flexibly without hindering the development of their potential.

In addition, self-confidence places more emphasis on active student involvement to be more confident in conveying ideas without fear and hesitation. With self-confidence, students will bring confidence in their ability to be positive and understand what they have done, be responsible for students' willingness to bear everything that has been the consequence, and be realistic, namely in dealing with a problem students can use the thinking accepted by the students. reasonable and in accordance with reality. Such a learning process will have a positive impact on increasing student self-confidence and help students develop self-confidence not to compare themselves with others.

In the open-ended approach, students are expected to be able to reason about the things they understand and what is in their minds to build the knowledge they have acquired. This is because if the ability of self-confidence is not developed in students, students will inhibit the development of their own potential so that they become someone who is pessimistic in facing challenges, afraid and hesitant in conveying ideas. This is reinforced by research by Fadhilah and Fitraini (2020) which states that using an open-ended approach has an effect or depends on the background of self-confidence. This is also supported by research by Nurhayati (2014) which states that to increase students' self-confidence, one alternative is to use an open-ended approach.

The increase in students' self-confidence questionnaires was obtained because: (1) Belief in one's own abilities was stronger with a sense of self-confidence (2) being able to carry out tasks by themselves so that they did not depend on others (3) being responsible (4) being more active in understanding material so that they can achieve high (5) continue to try to understand the material and ask the teacher if they cannot understand the material (6) Dare to express opinions so that they can practice their own courage.

5. Conclusion

The development of HOTS-based worksheets with an Open Ended approach aims to improve students' mathematical metacognition abilities and self-confidence. the average total validation of the RPP is 4.320, the Student Activity Sheet is 4.20 according to the validity criteria in the "Valid" category, 2) Practical, the HOTS-based Student Activity Sheet with the Open Ended approach that was developed meets the practicality criteria in terms of the analysis of the results of observations of the implementation of learning. The score obtained in the first trial was 2.752 (category "Implemented Less Well") and did not meet the criteria for the success of the study. However, after making several revisions, in the second trial the score for the observation of learning implementation increased to 3.73 (category "Well Implemented". "), 3) Effective, HOTS-based worksheets with an Open Ended approach to improve mathematical metacognition skills have been effective for use in learning which includes mastery learning calcically, in the first trial the achievement of pretest mathematical metacognition abilities was 50% (16 students) and posttest was 75% (24 students). While in the second trial the pretest was 40.62% (13 students) and the posttest was 81.25% (26 students).In the first trial the learning

objectives of the mathematical metacognition ability had not been achieved, it was obtained 75%, 62.5%, 75%, 50%. However, after making several revisions, in the second trial the learning objectives were achieved, the goals obtained were 79%, 88% 80.4%, 76% (completed). Student responses were positive, in the first trial the average student response was 90.85% and the second trial the average student response was 92.74%. The results of the analysis of increasing mathematical metacognition abilities in trials I and II showed that there was an increase in the average value of students' mathematical metacognition ability of 0.04. The average value of trial II (0.47) is greater than the average value of trial I (0.43) which starts from the planning stage, chooses the right strategy, then monitors progress in learning and simultaneously corrects if there are errors that occurs during understanding the concept. The results of the analysis of the increase in student self-confidence in trials I and II showed an increase in the average value of student self-confidence by 0.05. The average value of trial II (0.51) is greater than the average value of trial I (0.46).

REFERENCES

Alhadad, S F. (2010). *Meningkatkan Kemampuan Representasi Multipel Matematis, Pemecahan Masalah Matematis dan Self Esteem Siswa SMP melalui Pembelajaran dengan Pendekatan Open-ended*. Disertasi. UPI: Tidak dipublikasikan.

Andi Prastowo. (2012). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: Diva Press.

Becker, J.P. dan Shimada, S. (1997). *The Open-Ended Approach: A New Proposal for Teaching Mthematics*. Virginia: NCTM.

Cockroft. W. H. (1982). *Mathematics Counts, Report of the Committee of Inguiry Into the Teaching of Mathematics in Schools*. London: Her Majesty's Stationery Office.

Depdiknas. (2008). Panduan Pengembangan Bahan Ajar. Jakarta: Direktorat Jenderal Manajemen Pendidikan Dasar dan Menengah.

Fadillah dan Fitraini. (2020). *Pengaruh Penerapan Pendekatan Open Ended Terhadap Kemampuan Komunikasi Matematis Berdasarkan Self Confidence Siswa Madrasah Aliyah Kampar.* Jurnal Mathematics Learning. Vol 3, No 1.

Fitriani, N. (2014). *Penerapan Pendekatan Pendidikan Matematika Realistik Secara Berkelompok Untuk Meningkatkan Self Confidence Siswa SMP*. PROSIDING Seminar Nasional Matematika. Vol.1.

Hasratuddin. (2018). *Mengapa Harus Belajar Matematika.* Medan: Perc. Edira.

Kemendikbud. (2017). *Modul Penyusunan Soal Higher Order Thinking Skill (HOTS).* Jakarta: Direktorat Pembinaan SMA Ditjen Pendidikan Dasar dan Menengah

Lestari, K.E. dan Yudhanegara, M.R. (2015). *Penelitian Pendidikan Matematika*. Bandung : Refika Aditama.

Lestari, Selvia, & Layliyah. (2019). *Pendekatan Open Ended Terhadap Kemampuan Metakognitif Siswa: Alternatif Pembelajaran di Kurikulum 2013.* Jurnal. Vol 5, No 2.

Nurhayati, Aat. (2014). *Meningkatkan Kemampuan Koneksi Matematis, Self Confidence siswa melalui penerapan pendekatan pembelajaran saintifik Berbantuan Persoalan Open Ended.* Tesis Pendidikan Matematika.

Permendikbud. Nomor 58 Tahun 2014. Tujuan Pembelajaran Matematika. Jakarta: Menteri Pendidikan Nasional.

Purwanto. (2011). *Evaluasi Hasil Belajar*. Yogyakarta: Pustaka Pelajar.

Rahayu, L. P., & dkk. (2018). *Pengembangan Soal Matematika HOTS (Higher Order Thinking Skills) Kelas X Berdasarkan Triple Theory*. Efektor .

Simamora, R. E., Saragih, S., & Hasratuddin, H. (2018). Improving Students'Mathematical Problem Solving Ability and Self-Efficacy through Guided Discovery Learning in Local Culture Context. *International Electronic Journal of Mathematics Education*. https://doi.org/10.12973/iejme/3966.

Zakia, Nur Eva. (2014). *Pembelajaran degan Pendekatan Open Ended Untuk Meningkatkan Kemampuan Metakognitif dan Mathematical Habits Of Mind Siswa SMP.* Tesis Pendidikan Matematika