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DEVELOPMENT OF WORKSHEETS BASED ON THE METAPHORICAL THINKING APPROACH FOR STUDENTS' PROCEDURAL FLUENCY ABILITY

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Abstract

The mathematics materials in learning mostly used package books, but the provided resources in the school were limited and teachers did not optimize the existing technology to provide effective and interesting materials. As a consequence, students did not complete the exercise according to mathematical procedures and they were pessimistic. The general research purpose was to produce a metaphorical thinking approach-based worksheet for students' procedural fluency on valid characteristics. This study used research and development by the ADDIE stage model. The participant was 9th-grade students in junior high school. Data collection were observation, questionnaires, and interview techniques. The results showed that the characteristics of the developed worksheet have been valid. The results of the worksheet validity test were obtained by 90% and the results of the trial of students were 93%. The implications of this worksheet are helpful for students to independent learning, and this worksheet helps students solve mathematical problems in accordance with procedural, assisted by steps of the metaphorical thinking approach, teaching and learning activities are more effective.

Keywords: Metaphorical thinking approach, Procedural fluency, Worksheet development.

Abstrak

Materi matematika dalam pembelajaran paling sering bersumber dari buku paket, namun jumlah yang tersedia di sekolah terbatas dan guru tidak mengoptimalkan keberadaan teknologi untuk memberikan materi yang efektif dan menarik. Akibatnya, peserta didik tidak menyelesaikan latihan sesuai prosedur matematika dan mereka pesimis. Tujuan penelitian secara umum adalah menghasilkan Lembar Kerja Peserta Didik (LKPD) berbasis pendekatan berpikir metaforis untuk kelancaran prosedural mereka pada ciri-ciri yang valid. Penelitian ini menggunakan penelitian dan pengembangan dengan model tahapan ADDIE. Pesertanya adalah peserta didik kelas 9 di Sekolah Menengah Pertama. Pengumpulan data dilakukan dengan teknik observasi, angket, dan wawancara. Hasil penelitian menunjukkan bahwa karakteristik LKPD yang dikembangkan sudah valid. Hasil uji validitas LKPD diperoleh sebesar 90% dan hasil uji coba peserta didik sebesar 93%. Implikasi dari LKPD ini adalah membantu peserta didik untuk belajar mandiri, dan LKPD ini membantu peserta didik memecahkan masalah matematika sesuai dengan prosedural, dibantu dengan langkah-langkah pendekatan berpikir metaforis, kegiatan belajar mengajar lebih efektif.

Kata kunci: Kelancaran prosedural, Pendekatan metaphorical thinking, Pengembangan lembar kerja.

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INTRODUCTION

Mathematics is one of the subjects taught at every level of school, both elementary school, junior high school, senior high school to higher education. Through mathematics education, students are expected to become human beings who are able to think logically, conscientiously, carefully, critically, creatively, innovatively, imaginatively, and hardworkingly (Pratidiana & Muhayatun, 2021). The purpose of education is to identify and develop the existing creativity and potential innovations of each individual (Lai et al., 2019). In this case, it is very necessary that there is a learning of mathematics in schools. Teachers often face difficulties in applying thematic learning (Retnawati et al., 2017). Various efforts have been made to improve the quality of education, including the establishment of eight national education standards. In this case, it is very necessary to have mathematics learning in schools (Rashidov, 2020). One of the causes of low student achievement in mathematics learning is the learning process that includes cognitive and psychomotor abilities that are not optimal (Apertha, Zulkardi, & Yusup, 2018).

One of the cognitive aspects that must be mastered by students is mathematical procedural fluency (Zebua & Waruwu, 2022). Mathematical procedural fluency is the ability of students to choose and use appropriate procedures to solve a mathematical problem, without adequate procedural fluency, learners will have difficulty in deepening their understanding of mathematical ideas or solving mathematical problems (Phuong, 2020). The indicators of mathematical procedural fluency include choosing the right procedures to solve mathematical problems, using procedures that have been selected, utilizing procedures, modifying or improving procedures (Firdaus, 2019).

Based on observations by researchers to the 9th grade students in Madrasah Tsanawiyah (MTs) IT Bany Zuhud Wanasalam, learning classroom had been still teacher-centered, students tend to passively only listen and pay attention when the teacher explains the lesson in class. Few learners ask questions when given the opportunity to ask questions. Then students are asked to do practice questions related to the material presented, they find it difficult to do the practice questions independently because students are not used to it and always need help from the teacher. This is an activity that shows the characteristics of students not being able to learn independently and is very teacher-centered. Students do not yet know how to use the right procedures,

make good use of procedures and the lack of teaching materials are the main factors in them not being able to learn independently and try to solve the mathematical problems they face. Learning in this way really requires additional learning media if in the learning process there is only one learning resource, namely the teacher. As shown in Figure 1, learners have not been able to choose and use the procedure.

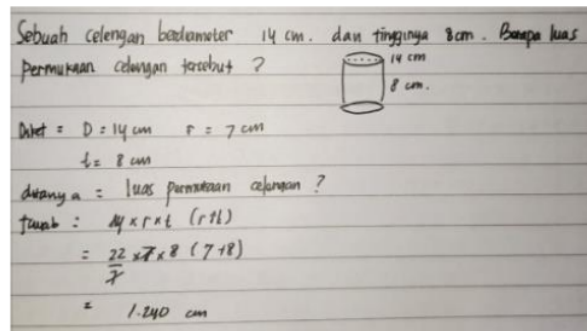


Figure 1. Student Work Results

One of the determining factors for the success of learning in the classroom is the use of learning media (Lisnawati, 2021; Syakur, Sugirin, & Widiarni, 2020). The urgency of using learning media as a learning tool is to help educators convey messages and learning materials to students effectively and efficiently (Pratama & Saregar, 2019). Therefore, it is necessary to select learning media that are in accordance with the needs, in order to achieve learning objectives.

Based on the results of interviews with mathematics teachers and the 9th grade students in MTs IT Bany Zuhud Wanasalam, the teaching materials used by the teachers are only sourced from package books provided from schools and the number is not comparable to the number of students. This causes students to only have explanations from the teacher, students tend to memorize the concepts learned instead of understanding so that when given practice questions they still need direction from the teacher. In addition to teachers' hard-to-remember explanations, the lack of learning media that can help lead them to solve math problems independently. Resulting in teachers feeling difficult and hampered in achieving learning goals. For this reason, teachers need other solutions so that learning activities run more effectively, such as additional teaching materials for teachers and students to make observations, ask questions, reason and so on. Thus, students' insights are not only in one material.

One form of visualization that can be done is through the students' worksheet. The purpose of using students' worksheet in the learning process is to strengthen and support learning in achieving indicators and competencies in accordance with the curriculum (Huda, Anggraeni, & Supriatno, 2020). Students' worksheet is defined as printed teaching materials in the form of sheets of paper containing tasks, implementation instructions, and steps for completing tasks on a certain material that must be done by students with reference to basic competencies and indicators that must be achieved (Jusmawati et al., 2021). The developed students' worksheet by the Researcher was designed to be as attractive as possible with language that is easy to understand the 9th grade students to foster the enthusiasm and motivation of students to learn it then combined with a metaphorical thinking approach that is able to overcome student learning problems, especially for problems of procedural fluency of students.

According to Hendriana (in Hasnarika, 2022) suggests that the metaphorical thinking approach is a bridge between model and interpretation, providing great opportunities for learners to exploit their knowledge in learning mathematics. Metaphor is the concept of thinking from an object or idea that has been known before to another unknown idea (Robutti et al., 2022). In addition, through a metaphorical thinking approach, it can make the learning process of students meaningful because students can see the relationship between the concepts they learn and familiar concepts (Angraini et al., 2022; Çağırğan, Karaduman, & Sönmez, 2021). In the metaphorical thinking approach abstract concepts are metaphorized into real objects that exist in everyday life (Yetti & Afriyani, 2021). The characteristic of the metaphorical thinking approach is to bridge abstract concepts into more concrete things.

Learning steps using a metaphorical thinking approach are giving contextual problems, identifying key concepts, using metaphors to identify key concepts and drawing conclusions (Yetti & Afriyani, 2021). These learning steps will later be packaged in the form of worksheets that can direct students to be more independent in solving mathematical problems and encourage students to be able to solve practice problems according to the right procedures. So that later students will be more independent and have no difficulty in doing exercises both in class and at home.

Based on the results of observations and interviews and then the results of reviewing the opinions of previous relevant researchers, it is necessary to develop

varied teaching materials in the form of worksheet which can be effective teaching materials for students, as well as help students in solving mathematical problems because they are in accordance with mathematical procedures..

RESEARCH METHODS

The method used in this study is Research and Development. A series of processes or steps in order to develop a new product or perfect an existing product so that it can be accounted for (Sukmana, Supriatna, & Wardhani, 2022). In research and development of the metaphorical thinking approach-based worksheet, researchers use the ADDIE development model consisting of five steps in Figure 2, namely: 1) Analysis 2) Design 3) Development 4) Implementation 5) Evaluation (Setiadi, Yuliatmojo, & Nurhidayat, 2018).

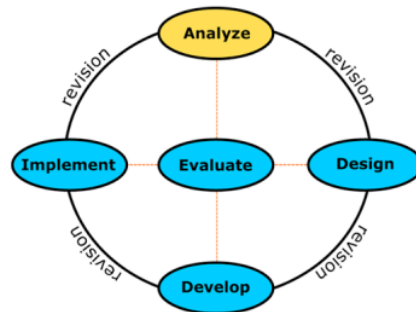


Figure 2. ADDIE Development Model Framework

The development procedure for the metaphorical thinking approach-based worksheet through a five-step ADDIE development model: 1) Analysis, namely Teacher Needs Analysis and Student Needs Analysis. 2) Design, namely Making Initial Drafts and Material Preparation. 3) Development, namely students' worksheet making and validity testing by Experts (material experts, media experts and linguists). 4) Implementation, i.e. Formative Evaluation (one-to-one evaluation, small group evaluation, field test) 5) Evaluation. This research was carried out in the even semester of the 2021/2022 academic year at MTs IT Bany Zuhud Wanasalam. The subject of the study was the 9th students in MTs IT learner Bany Zuhud, involving 31 learners. Then material experts, media experts and linguists involving Three Lecturers of Mathla'ul Anwar University Banten.

The types of data used in this study are in the form of qualitative and quantitative data, qualitative data in the form of criticism, suggestions and responses of experts and students while quantitative data consists of expert validation questionnaire sheets and student trial questionnaires. The data collection instrument used by researchers for the validation stage of experts used a closed questionnaire made using a rating scale while the student coa test questionnaire was made using a likert scale. The data analysis technique used in this development research is descriptive statistics, descriptive statistics is a way of analyzing data by describing or describing the data that has been collected sober without intending to make conclusions that apply to the public or generalizations. Assessments carried out by experts and students are processed with simple statistical data, namely using questionnaires with a grading scale range of 1 to 4. The score conditions used with the details in Table 1.

Table 1. Scoring and Its' Category

Score	Category
4	Excellent
3	Good
2	Not Good Enough
1	Very Bad

After the data were obtained from expert review activities and student trials, calculations were carried out to determine the quality of the metaphorical thinking approach-based worksheet for the procedural smoothness of students on the 9th grade in MTs IT Bany Zuhud Wanasalam. The trial calculation criteria for calculating the average score can be known using the following formula in Figure 3.

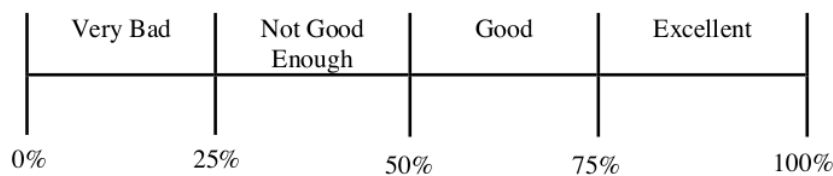


Figure 3. Criteria Score Range Line

The validity used for students' worksheet is based on metaphorical thinking based on the validity proposed by BSNP (Doyan, Susilawati, & Hardiyansyah, 2021). While the validity for the questionnaire sheet is the validity proposed by Arifin (2017). The students' worksheet products are said to be valid if students' worksheet products have

met the requirements with the level of material accuracy, media feasibility and language suitability in the excellent or good category. The indicator for validating by expert presented in Table 2.

Table 2. Specification for the Material Expert Validation

Aspects	Indicators	Grain
Eligibility of Contents	Material Coverage	4
	Accuracy of the Material	3
	Relevansi	4
Eligibility of Presentation	Completeness of Serving	3
	Presentation of Information	4
	Presentation of Learning	5
Based on a Metaphorical Thinking Approach	Contextual Problem Giving	1
	Identify Key Concepts	1
	Using Metaphors to Identify Key Concepts	1
	Conclusion	1
Number of Grains		27

RESULTS AND DISCUSSION

One of the models of development research is the ADDIE development model. The ADDIE model consists of five steps, namely: 1) Analysis 2) Design 3) Development 4) Implementation 5) Evaluation. These five steps are a stage of development where the product will be developed into a better product. The following is an explanation of the stages in developing students' worksheet products based on a metaphorical thinking approach.

Analysis

There are two steps at the analysis stage carried out by the researcher, namely: needs analysis and curriculum analysis. At the needs analysis stage, researchers conducted observations and interviews with teachers of mathematics subjects and the 9th students in MTs IT Bany Zuhud Wanasalam. Based on the observations made by researchers to the 9th grade students in MTs IT Bany Zuhud Wanasalam, it can be seen that learning is still teacher-centered, students tend to be passive only listening and paying attention to the teacher's explanation. Only a few learners ask questions when given the opportunity to ask questions. Then students are asked to do practice questions related to the material presented, they find it difficult to do the practice questions and many of them are still

very confused to start the initial steps of doing the questions.

Then the results of the interview to the teacher stated that one of the factors for the ineffectiveness of learning in the classroom was the lack of teaching materials as a very important learning support. In learning, students only get material from the teacher's explanation and the teacher only conveys the material contained in the package book provided from the school with an amount that is not proportional to the number of students resulting in students experiencing difficulties in completing some tasks or exercises or lack of cognitive abilities possessed by students.

Then from the results of observations made at MTs IT Bany Zuhud, researchers got information that the curriculum used in MTs IT Bany Zuhud was a simplified 2013 curriculum. By conducting a curriculum analysis, it can be known the objectives that must be achieved by basic competence 3.7, namely Generalizing the surface area and volume of various curved side chambers (tubes, cones, and balls), and basic competence 4.7, namely Solving contextual problems related to surface area and volume of the curved side space (tubes, cones, and spheres) on the material of the curved side room.

The results of observations in the classroom, interviews and observations are used as material to develop students' worksheet products that are in accordance with the needs of students. The observation and interview situation presented in Figure 4. Based on the results of the needs analysis and curriculum analysis, the researcher seeks to develop metaphorical thinking approach-based worksheet for the procedural smoothness of students which can later hone the cognitive abilities of students, so that the learning process is more effective and more meaningful.



Figure 4. Observation and Interview Stages

Design

At this research stage, the researcher compiled a design to develop an students' worksheet product based on a metaphorical thinking approach to the 9th grade curved

side room building material. The design stages that have been carried out by the researcher are as follows: a) Planning learning objectives, learning activities, learning content and the assessment process. The material content in the students' worksheet developed by researchers is adjusted to the core competencies and basic competencies of mathematics for 9th grade in junior high school curriculum 2013 revised in 2020 material to build curved side rooms. Each activity contains a metaphorical thinking component. b) Researchers begin to design students' worksheet designs that are developed according to needs analysis and curriculum analysis. This students' worksheet is designed by paying attention to design principles in order to attract attention and motivate students. c) The compiler designs the product in accordance with the material and learning approach chosen by the researcher, namely build a curved side room using the metaphorical thinking approach. The designed students' worksheet consists of the students' worksheet cover, foreword, steps of the metaphorical thinking approach, procedural smoothness indicators, **table of contents, basic competencies and achievement indicators, concept maps, worksheets, honing abilities, reference lists, author biodata, like in Figure 5.**

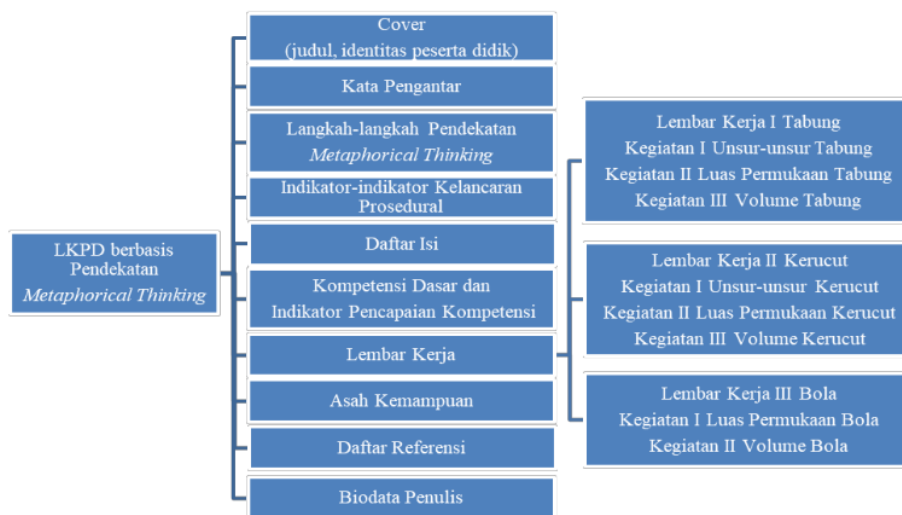


Figure 5. Worksheet chart

The designed product model like the students' worksheet cover (Figure 6a), table of contents (Figure 6b), and concept maps (Figure 6c) presented in Figure 6.

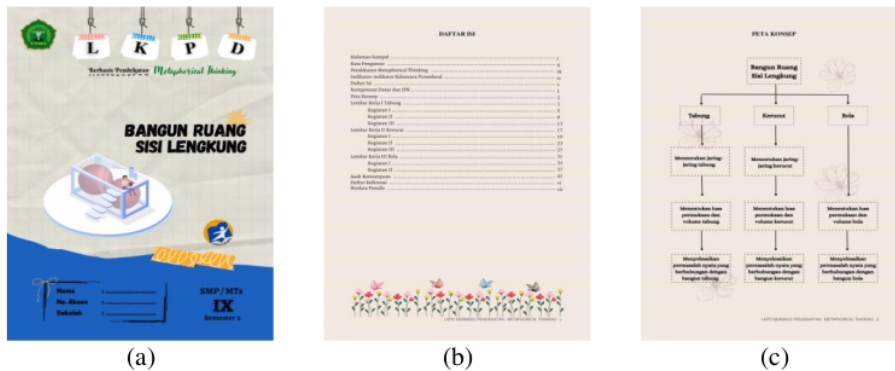


Figure 6. Worksheet draft

Development

At this stage, researchers carry out product development in two stages, namely the students' worksheet development process and expert testing. The students' worksheet product development process begins with the preparation of a draft to illustrate the students' worksheet cover illustration. Then the preparation of the manuscript of the students' worksheet content, determining the design in Canva and then the researcher ensures the device to be used to make the students' worksheet, giving the title to each students' worksheet activity, determining the color and typeface as well as the size of the writing for the cover and content of the students' worksheet, making design formats, editing students' worksheet activities and layouts, entering writing, drawings and materials to build curved side rooms in the students' worksheet design layout. Furthermore, the draft students' worksheet is submitted to the experts in the Expert Review test. The students' worksheet that has been developed is then validated by experts, namely material experts, media experts and linguists. This validation test is carried out to determine the feasibility of the metaphorical thinking approach-based worksheet and ask for advice or input related to the teaching materials developed. The following are the results of the expert recapitulation in Table 3.

Table 3. Expert Test Recapitulation Results

Expert	Result Score
Material Expert	79%
Media Expert	94%
Linguist	96%

Based on the results of the recapitulation of assessments from experts referring to the product feasibility category (material accuracy, media feasibility and language suitability), the students' worksheet based on the metaphorical thinking approach obtained the category of excellent (very valid). In this validation process, researchers get some suggestions or inputs on the product being developed. After making improvements on the advice of experts, in the next stage that students' worksheet (the model presented in Figure 7) is tested on students.



Figure 7. Final Worksheets

Implementation

Implementation is a real step to implement the learning system we are creating (Trisiana & others, 2019). After the product is revised and declared feasible, students' worksheet is tested on students. Researchers conducted a trial for the 9th grade students' in MTs IT Bany Zuhud Wanasalam to find out the responses of students and get input on the products developed by providing questionnaires. There are three stages of the students' worksheet trial for students, namely: one-to-one evaluation involving three students, small group evaluation involving 8 students and the field test involving 20 students. The following are the results of the recapitulation of the student trial in Table 4.

Table 4. Student Trial Recapitulation Results

Phase	Percentage
One-to-one Evaluation	90%
Small Group Evaluation	93%
Field Test	95%
Average Percentage	93%

The results of the trial assessment of the one-to-one evaluation stage, small group evaluation and field test (the assessment situation presented in Figure 8) in Table 4 obtained a percentage score of 93%. Based on the results of the percentage score, the

students' worksheet based on the metaphorical thinking approach can be categorized as very good (very valid).



Figure 8. One-to-one Evaluation, Small Group and Field Test

Evaluation

At each stage of development, students' worksheet products based on Metaphorical Thinking have an evaluation stage. Both in the design, development and implementation stages. The evaluation obtained is by including suggestions and comments from experts, namely material experts, media experts and linguists. Some recommendation for revision presented in Tabel 5. As well as conducting user trials for the 9th students in MTs IT Bany Zuhud Wanasalam with 3 stages of evaluation, namely one-to-one evaluation, small group evaluation and field test.

Table 5. Product Revision by Experts

Expert	Revision
Material	Addition of procedural smoothness indicators Addition of social aspects
Media	Replacement of illustrations on each activity Addition of answer sheets Addition of the sentence "procedural fluency ability" on the students' worksheet's cover Omission of ribbon illustrations on students' worksheet covers
Language	Replacement of the word "conclusion" to "conclusion"

The assessment results from experts obtained the results of the percentage of product feasibility with a material expert score of 79%, media experts by 94% and linguists by 96% and based on the percentage of these scores, the students' worksheet based on Metaphorical Thinking is categorized as very good.

The results of the user test of students go through three stages, namely the one-to-one stage, small group and field test by obtaining the results of the percentage of product feasibility with a one-to-one evaluation score of 90%, small group evaluation of

93% and field test of 95%, then the students' worksheet based on Metaphorical Thinking is categorized as very good.

Discussion

The efforts made by a teacher so that learning objectives are achieved can be seen in the Minister of Education and Culture No. 22 of 2016 concerning Standards for the Primary and Secondary Education Process, namely teachers are able to design effective learning (Sudana, 2018). Therefore, it is necessary to select learning media that are in accordance with the needs, in order to achieve learning objectives. The urgency of using learning media as a learning tool is to help educators convey messages and learning materials to students effectively and efficiently (Pratama & Saregar, 2019).

One form of visualization that can be done is through the students' worksheet. Students' worksheet is defined as printed teaching materials in the form of sheets of paper containing tasks, implementation instructions and steps for completing tasks on a certain material that must be done by students by referring to basic competencies and indicators that must be achieved (Jusmawati et al., 2021). Students' worksheet combined with metaphorical thinking approach, according to Hendriana (in Hasnarika, 2022) suggests that the metaphorical thinking approach is a bridge between model and interpretation, providing a great opportunity for students to exploit their knowledge in mathematics learning.

This research and development resulted in a product in the form of students' worksheet based on Metaphorical Thinking for the Procedural Smoothness Ability of Students to Build Curved Side Rooms for 3rd grade junior high school. This product is a learning resource designed using canva assisted by Microsoft Word 2012. Using the development model used in this study is the ADDIE development model (Barlenti, Hasan, & Mahidin, 2017). The ADDIE development model consists of five stages, namely analysis, design, development, implementation, and evaluation (Setiadi et al., 2018). These five steps are a stage of product development where the product will be refined or developed into a better product (Sukmana et al., 2022).

This development research was carried out based on the needs and curriculum analysis that researchers conducted at MTs IT Bany Zuhud Wanasalam. Based on the results of the study, it was found that there was a shortage of teaching materials in the

form of students' worksheet, and the available students' worksheet was not equipped with an attractive appearance. According to the results of interviews conducted by researchers to teachers of mathematics subjects and some students that learning seems monotonous, less effective and students are less active, thus affecting the cognitive abilities of students.

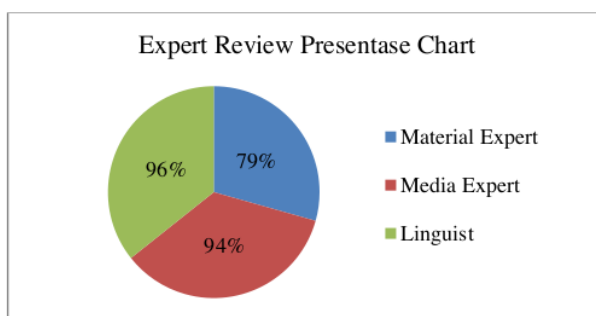


Figure 9. Expert Test Assessment Percentage Chart

Then this students' worksheet was designed by researcher and validated by three material experts, namely material experts, media experts and linguists. The validity used for the questionnaire question is the validity stated by Arifin (2017), namely the validity of the content and the validity of the face. Meanwhile, the validity used for students' worksheet is based on a metaphorical thinking approach based on the validity stated by BSNP (Doyan, Susilawati, & Hardiyansyah, 2021), namely content feasibility, presentation feasibility, language feasibility, and graphic feasibility. The following are the results of the recapitulation of the percentage of validation results and students' worksheet trials based on the metaphorical thinking approach for the smoothness of students in Figure 9.

Table 6. Average Percentage of Expert Review Assessment Results

Expert	Percentage
Material Expert	79%
Media Expert	94%
Linguist	96%
Average Percentage	90%

Based on the results of the average percentage of assessment conducted by the expert review in Table 6, it can be concluded that students' worksheet based on the metaphorical thinking approach for the procedural smoothness ability of students gets

very good criteria or can be said to be valid. In continuum it can be seen as follows in Figure 10.

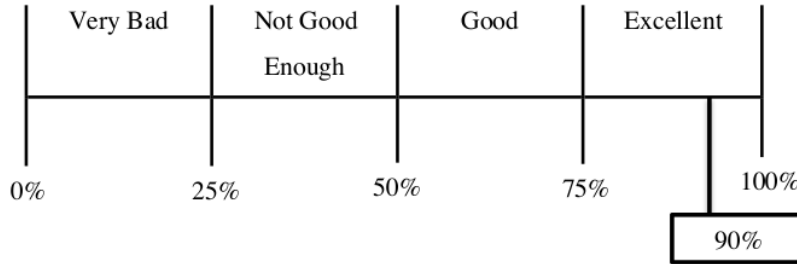


Figure 10. The average criterion line of expert test assessment

After the expert test stages, the next stage is implementation. Implementation is a real step to implement the learning system we are creating. Researchers implement MTs IT grade 3 student Bany Zuhud through three stages in Figure 11.

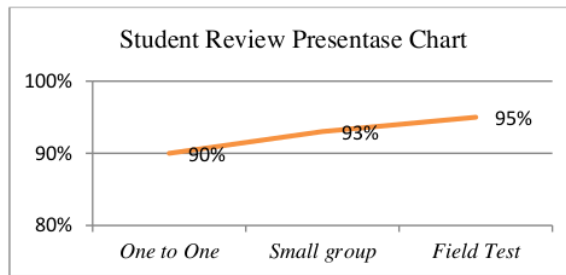


Figure 11. Learner Trial Assessment Percentage Chart

Based on the assessment chart in Figure 11, the trial of students' worksheet product users went through three stages, namely **one-to-one evaluation, small group evaluation and field test**. For **the** percentage score obtained has increased at every stage with an average percentage of 93% in Table 7, it can be interpreted that the students' worksheet product based on the metaphorical thinking approach has developed into a product that is suitable for use by students.

Table 7. Average Percentage of Student Trial Results

1	Phase	Percentage
	One-to-one Evaluation	90%
	Small Group Evaluation	93%
	Field Test	95%
	Average Percentage	93%

Based on the average percentage of the results of trials conducted by students in Table 7, it can be concluded that students' worksheet based on the metaphorical thinking approach gets very good criteria or can be said to be valid. In continuum it can be seen as follows in Figure 12.

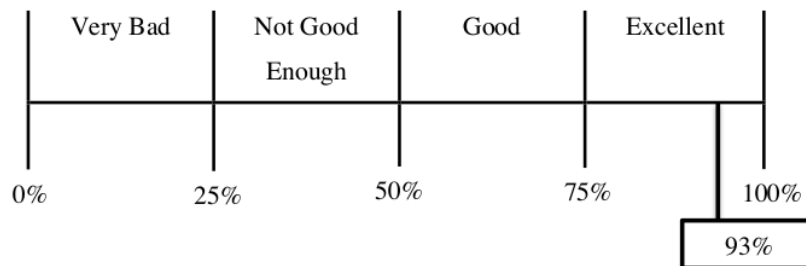


Figure 12. The average criterion line of student trial results

In the One-to-one evaluation stage, researchers are assisted by homeroom teachers to determine the students who conduct product trials. The homeroom teacher selected students with three categories according to the ability of the learners in Table 8. Sindi with high category, Roheni with medium category and Egi with Low category.

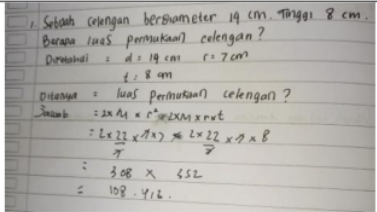
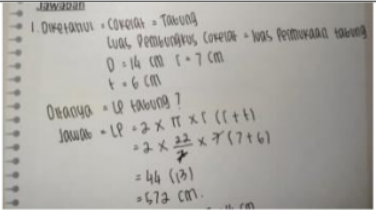
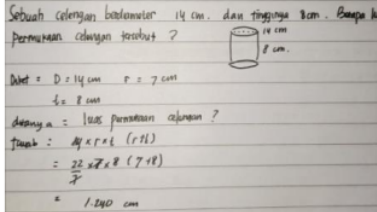
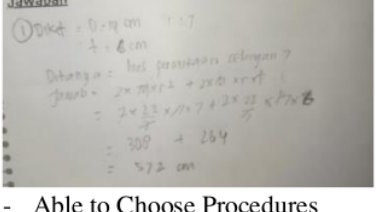
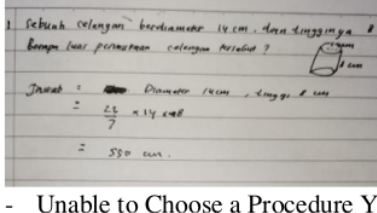
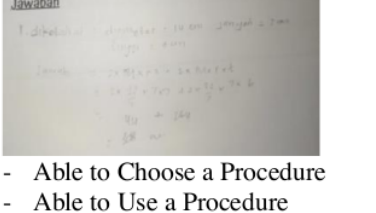
Table 8. Recapitulation of One-to-one Evaluation

Student Name	Number of Assessment Items	Maximum Score	Earned Score	Percentage Score
Sindi	9	36	33	92%
Roheni	9	36	32	89%
Egi	9	36	32	89%
Sum	27	108	97	276%
Overall Score Percentage				90%

³⁵ Based on Table 8, it can be seen that the students' worksheet trial conducted by students with high, low, and medium categories got very good percentage score results. It can be interpreted that this students' worksheet can be said to be valid for use by students ⁴⁹ in the high, medium, and low ability categories. The metaphorical thinking approach-based worksheet makes students more active and more motivated in learning, and the steps presented in this students' worksheet help students in solving mathematical problems easily because they are adjusted to indicators of procedural fluency that is, it includes choosing the right procedures to solve mathematical

problems, using selected procedures, utilizing procedures, modifying or improving procedures (Firdaus, 2019). It can be seen from the work of students in Table 9.

Table 9. Student Work

Name	Before using students' worksheet	After using students' worksheet
Sindi (high category)	 <p>1. Sebuah selang berdiameter 14 cm. Tinggi 8 cm. Berapa luas permukaan selang? Diketahui : $d = 14 \text{ cm}$ $r = 7 \text{ cm}$ $t = 8 \text{ cm}$ Ditanya : luas permukaan selang? Jawab : $2 \times \pi \times r \times t$ $= 2 \times 22 \times 7 \times 8$ $= 616 \text{ cm}^2$</p>	 <p>Jawaban 1. Diketahui : $d = 14 \text{ cm}$ $r = 7 \text{ cm}$ $t = 8 \text{ cm}$ Ditanya : LP tabung? Jawab : $LP = 2 \times \pi \times r \times (r + t)$ $= 2 \times 22 \times 7 \times (7 + 8)$ $= 672 \text{ cm}^2$</p>
Roheni (medium category)	 <p>Sebuah selang berdiameter 14 cm. dan tingginya 8 cm. Berapa luas permukaan selang tersebut? Diket : $D = 14 \text{ cm}$ $r = 7 \text{ cm}$ $t = 8 \text{ cm}$ Ditanya : luas permukaan selang? Jawab : $2 \times \pi \times r \times (r + t)$ $= 22 \times 7 \times (7 + 8)$ $= 1.240 \text{ cm}^2$</p>	 <p>Jawaban 1. Diket : $D = 14 \text{ cm}$ $r = 7 \text{ cm}$ $t = 8 \text{ cm}$ Ditanya : luas permukaan selang? Jawab : $2 \times \pi \times r \times (r + t)$ $= 2 \times 22 \times 7 \times (7 + 8)$ $= 572 \text{ cm}^2$</p>
Egi (low category)	 <p>1. Sebuah selang berdiameter 14 cm. dan tingginya 8 cm. Berapa luas permukaan selang tersebut? Jawab : $2 \times \pi \times r \times (r + t)$ $= 22 \times 7 \times (7 + 8)$ $= 580 \text{ cm}^2$</p>	 <p>Jawaban 1. Diketahui : $d = 14 \text{ cm}$ $r = 7 \text{ cm}$ $t = 8 \text{ cm}$ Ditanya : luas permukaan selang? Jawab : $2 \times \pi \times r \times (r + t)$ $= 22 \times 7 \times (7 + 8)$ $= 68 \text{ cm}^2$</p>

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CONCLUSION

Based on the results of this development research, it was concluded that the metaphorical thinking approach-based worksheet for the procedural smoothness ability to the 9th students Curved Side Room Building Materials was declared very good or very valid. Based on validation tests by the material, media, and linguists experts with an average percentage of 90% and have been tested by users with stage one-to-one evaluation, small group evaluation and field test with an average percentage of 93%.

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