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Development of Middle School Geometry Teaching Materialsby Utilizing Learning Resources in the Neighborhood

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Abstract: ***This study aims to produce Middle School Geometry Teaching Materials that utilize learning resources in the environment around students, which include Learning Implementation Plans (RPP), Student Worksheets (LKPD), and Student Achievement Tests (TPB) which are valid, practical, and effective. This research is a developmental research (Thiagarajan, et. al, 1978) which is modified into 3 (three) stages, namely: (1) the defining stage (define); (2) the design stage (design); (3) the development stage. The subjects of the research trial were 25 class IX students at SMP Negeri 1 Siau Timur Selatan, two teachers from that area. The research instruments used were validation sheets, teacher practicality sheets, student practicality sheets, learning implementation observation sheets, and TPB. The research instruments used were validation sheets, teacher practicality sheets, student practicality sheets, learning implementation observation sheets, and TPB. This research produces teaching materials for junior high school geometry that utilize learning resources in the surrounding environment, including lesson plans, LKPD, and TPB. After going through the stages of development, the resulting products, namely RPP, LKPD, and TPB meet Nieveen's (1999) criteria which include valid, practical, and effective criteria.***

Keywords: Development, Teaching Materials, Learning Resources, Surrounding Environment

1. Preliminary

One of the problems faced by the world of education in Indonesia is the problem of weak learning processes. The old paradigm in the learning process is that the teacher teaches with a lecture strategy and students sit, be silent, listen, take notes and memorize. Such an atmosphere does not support students to fully participate in learning. As stated by Tileston (2007) that the atmosphere of the learning environment in the classroom is very important to support students to be more enthusiastic in the learning process. Teachers must be able to create a classroom environment with a pleasant atmosphere and support students to be actively involved, so that they have a high enthusiasm for learning. Mathematics has an important role in life. Mathematics is the basis for national prosperity in providing materials/ tools for understanding science, engineering, technology, and economics (Gauhar, 2012). Mathematics can be interpreted and understood as a discipline that is coherent, structured and between one part and another there is an interrelationship. Based on this fact, it appears that mathematics must be understood by students because it has an important role in life. One branch of mathematics is geometry. The importance of geometry can be seen from the many mathematical concepts that can be shown or explained with geometric representations. The purpose of learning geometry is for students to gain confidence about their mathematical abilities, become good problem solvers, be able to communicate and reason mathematically, develop spatial intuition, impart knowledge to support other material, and be able to read and interpret mathematical arguments (Kartono, 2010). Matters related to geometry are already known to students from an early age, even before they take formal education. Based on these facts, geometry should have a greater chance of being understood by students compared to other branches of mathematics.

The current learning atmosphere is that students still have difficulty understanding geometry, especially for geometric shapes. This can be seen from the results of school examination reports in the last five years that there are still many students who have below average absorption in geometric material. For example, the report on the results of the exam at SMP Negeri 1 Siau Timur Selatan as seen from students' absorption of spatial material, the results decreased from 2021 and 2022. In 2018, the percentage of absorption for the ability to determine elements in geometric shapes was recorded 55.12% of 200 students, the ability to solve problems related to spatial framework or nets is 87.32%, the ability to solve problems related to the volume of geometric shapes is recorded 57.56%, and the ability to solve problems related to surface area building space recorded 66.34%. In 2022, the percentage of absorptive capacity for the ability to determine elements in a spatial structure is 52.12%, the ability to solve problems related to frameworks or spatial networks decreases to 65.28%, and the ability to solve problems related to surface area and the volume of building space decreased, namely to 53.63% and 54.41%. Based on these data, the big question mark is why this can happen, even though geometric material has a great opportunity for students to understand because there are many things in the surrounding environment that are related to geometric shapes. The causes of this problem are related to the learning process, teaching methods and teaching materials used by teachers. Piaget stated that knowledge is built in the child's mind. Teachers must provide opportunities for students to develop all their potential and build their own knowledge. So that students will no longer have difficulty applying the knowledge they have to solve mathematical problems. NCTM (2000) states that problem solving is one of the focuses in learning mathematics, students must be able to become good problem solvers to be able to fully and meaningfully understand mathematics. Mathematics

learning should start from concrete (real) things so that it is easier for students to understand abstract mathematical concepts and build knowledge in their minds. Experience with concrete objects in the environment around students will greatly assist students in underlying understanding of abstract concepts. The thing that needs to be regretted is that teachers often do not bridge abstract concepts with experiences or concrete things.

Based on a survey conducted at three schools in the Siau Islands Regency, Tagulandang Biaro and four teachers at the school, it was found that the teaching materials used by teachers so far were not interesting and varied. The world of education is inseparable from the environment. There are many things in the environment that can be used as tools / materials to support the learning process. The environment in learning acts as a learning object that can provide real and direct experience to students. Various kinds of learning resources can be found in the environment, whether used directly or indirectly. Learning resources that are usually used by teachers are textbooks. Even though there are many learning resources in the environment around students such as schools, at home, and in the community. It's just that the abundant learning resources have not been utilized as well as possible. In classroom learning, the use of learning resources in the environment around students is very important to achieve optimal learning outcomes.

Based on the description above, the researcher is interested in developing teaching materials for junior high school geometry by utilizing learning resources in the surrounding environment. Various studies suggest that instruction or learning as a system that aims to assist the student learning process, which contains a series of events that are designed, arranged in such a way as to support and influence the internal student learning process (Aunurrahman, 2010). Nitko (2007: 18) mentions learning is defined as a process used to direct students towards a condition that helps them achieve learning targets.

Kennedy (2008) describes that meaningful mathematics is student - oriented learning, not teacher - oriented learning. Effective mathematics learning can be done through guided discovery, meaningful learning and problem solving. The six principles for school mathematics highlight the themes (NCTM, 2000): (1) Justice. Quality excellence in mathematics education demands fairness, high expectations and strong support for all students, (2) Curriculum. A curriculum is more than a set of activities: the curriculum must be coherent, focus on essential mathematics, and be well articulated from grade to grade level, (3) Teaching. Effective mathematics teaching demands understanding of what students know and need to learn and then challenging and supporting them to learn it well, (4) Learning. Students must study mathematics with understanding, actively build new knowledge from experience and previous knowledge, (5) Assessment. Assessment must support the learning of important mathematics and provide useful information for students and teachers, (6) Technology. Technology is essential in the teaching and learning of mathematics, technology influences the mathematics taught and enhances students' learning. In essence, this universe is a source of learning for humans of all time. In the learning process there are many resources and resources that can be utilized and managed, either intentionally provided or those that are widely available around us. All parties involved in learning need resources / potentials / power that can support the learning process.

According to AECT (Association for Educational Communications and Technology), learning resources are anything or power that can be utilized by teachers, either separately or in a combined form, for the benefit of teaching and learning with the aim of increasing the effectiveness and efficiency of learning objectives. AECT (Association for Educational Communications and Technology) defines learning resources as all sources (data, people, and goods) that can be used by students as a separate source or in combination to facilitate learning including messages, people, material tools, techniques, and the environment. . So, learning resources are anything that can be used to help everyone learn to display their competence. In terms of type or origin, AECT (1977) distinguishes learning resources into two: (1) Learning resources by design, namely learning resources that are deliberately made for learning purposes. Examples are: textbooks, modules, audio programs, sound slide programs, transparencies (OHT). (2) Learning resources that are already available and are still being utilized (learning resources by utilization), namely learning resources that are not specifically designed for learning purposes, but can be found, selected, and utilized for learning purposes. According to Jerolimek (1985) teachers need to use various learning resources in learning for various reasons. According to Komalasari (2010), the functions of learning resources in learning are as follows: (1) Sources of information in the learning process; (2) Overcoming the limitations of learning experiences; (3) Going beyond the boundaries of the classroom (4) Allowing direct interaction (5) Allowing uniformity of observation (6) Instilling new concepts (7) Generating new interests (8) Generating motivation (9) Providing a holistic experience. Dick and Carey (1978) mention several criteria that need to be considered in selecting learning resources, namely: (1) availability of resources; (2) availability of funds, manpower and facilities; (3) flexibility, practicality and durability (age) of learning resources; and (4) the effectiveness of learning resources for a long time. So the teacher must be careful to choose learning resources that are simple but can increase the effectiveness of learning. Warger, et al (2009) stated that the term environment shows the totality of the surrounding environment and the conditions in which something or someone lives or functions. A learning environment begins with a physical space, a virtual world, or at least a set of principles that have their origins in conventional models. The learning environment includes learning resources and technology, teaching tools, ways of learning, connections with social and global contexts, dimensions of human behavior and culture, including the important role of emotions in learning, the role of teachers and students in utilizing space and bringing wider social influence in Education. Swarat (2008) states that interesting learning topics for students are topics that are relevant to their lives, the physical environment or the social environment they have. In terms of the environment as a source of learning. Semiawan et al (1992) argue that no matter how small or remote, a school has at least four types of rich and useful

learning resources, namely: (1) Rural or urban communities around the school, (2) The physical environment in the school environment, (3) student materials that are not used and used items that are wasted which can cause environmental pollution, but if we process them they can be useful as resources and teaching and learning aids, and (4) natural events and events that occur in society that attract the attention of students. Teachers often find it difficult to find ideas/ideas for mathematics learning resources from the surrounding environment, which can support the achievement of certain basic competencies in science for students. Tileston (2007: 4) states that most students can be taught anything as long as it is relevant to their world. This means that students have the ability to accept any concept or material as long as it is bridged with something that is relevant and familiar to them. According to the National Center for Vocational Education Research Ltd/National Center for Competency Based Training in the Handbook for the Development of Teaching Materials (High School Development Directorate, 2008), teaching materials are all forms of materials used to assist teachers/instructors in carrying out teaching and learning activities in class. The material in question can be in the form of written material or unwritten material. The definition of teaching materials used in the Teaching Materials Development Guidebook issued in the framework of the Education Unit Level Curriculum training is a set of materials that are arranged systematically so as to create an environment/atmosphere that allows students to learn. The guide also mentions several principles in the development of teaching materials, including the following. (1) Starting from the easy to understand the difficult, from the concrete to understand the abstract. Students will more easily understand a certain concept if the explanation starts from something easy or something concrete, something that is real in their environment. (2) Repetition will strengthen understanding. In learning, repetition is needed so that students better understand a concept. Repetition in writing learning materials must be presented appropriately and varied so that it is not boring. (3) Positive feedback will provide reinforcement of student understanding. Often we take it lightly by giving a modest response to student work. In this study, the teaching materials that will be produced are printed teaching materials. The choice to produce printed teaching materials is because according to Steffen Peter Ballstaedt in the Guide to the Development of Teaching Materials (Directorate of Upper Middle School Development, 2008: 11), printed teaching materials have several advantages, namely: (1) Written materials usually display a table of contents, making it easier for a teacher to show students which part is being studied. (2) Procurement costs are relatively small. (3) Written materials are used quickly and can be moved easily. (4) The arrangement offers a wide range of convenience and creativity to the individual. (5) Written materials are relatively light and can be read anywhere. (6) Good teaching materials will be able to motivate readers to carry out activities, such as marking, taking notes, sketching. (7) Written material can be enjoyed as a document of great value. (8) Readers can set the tempo independently. Geometry may be visual fiction or patterning, but itis fiction that connects to significant features of the external world. Geometry has an abstract concept, but can be modeled with something concrete. French (2004: 2) states that various ways of solving geometric problems can be approached in several ways: by means of being tested, practiced directly where problems are solved by measuring, and calculating. Kennedy, Tipps, & Johnson (2008: 397) suggests step by step from the stages of students in understanding geometry, namely the first stage (visualization) in which children recognize common shapes such as circles, squares, triangles and rectangles. They called cubes, spheres, pyramids and cones less formal names such as squares and spheres. At this stage children begin to develop and expand their spatial visualization skills before entering school. The second stage (analysis), students learn to identify the unique characteristics of all solid objects with various geometric situations and materials, then in the third stage (informal deduction), children classify plane shapes (two dimensions) and spatial shapes (three dimensions). According to the characteristics of the wake. The questions and problems faced in elementary education provide a background for studies in secondary and high schools for more formal, deductive learning. Kennedy, Tipps, & Johnson (2008: 397) also suggest that a student operating at the visualization stage (stage 0) has not been able to fully engage in an activity that emphasizes analysis (stage 1) or informal deduction (stage 2). After a student is competent in visualization (stage 0), then new activities can be offered. It is further stated that Student Worksheets designed for students working individually or in groups can be used to explore geometric concepts informally, and through manipulation of real objects and graphical representations, so that students can mention or describe geometric shapes, characteristics, relationships, positions, and the nature of a wake.

2. Prosedure Penelitian

The type of research is the Thiagarajan development method (Thiagarajan, et. al, 1978) which is modified to include 3 (three) stages, namely Define, Design and Develop. This research is focused on developing teaching materials for junior high school geometry that utilize learning resources in the surrounding environment. The teaching materials developed are in the form of Learning Implementation Plans (RPP), Student Activity Sheets (LKPD), and Learning Achievement Tests (TPB). The product trial was conducted on Class IX - 1 students of Siau Timur Selatan 1 Siau State Middle School, SitaroRegency. The quality of the developed product is assessed based on Nieveen's criteria (1999) which include aspects of validity, practicality and effectiveness.

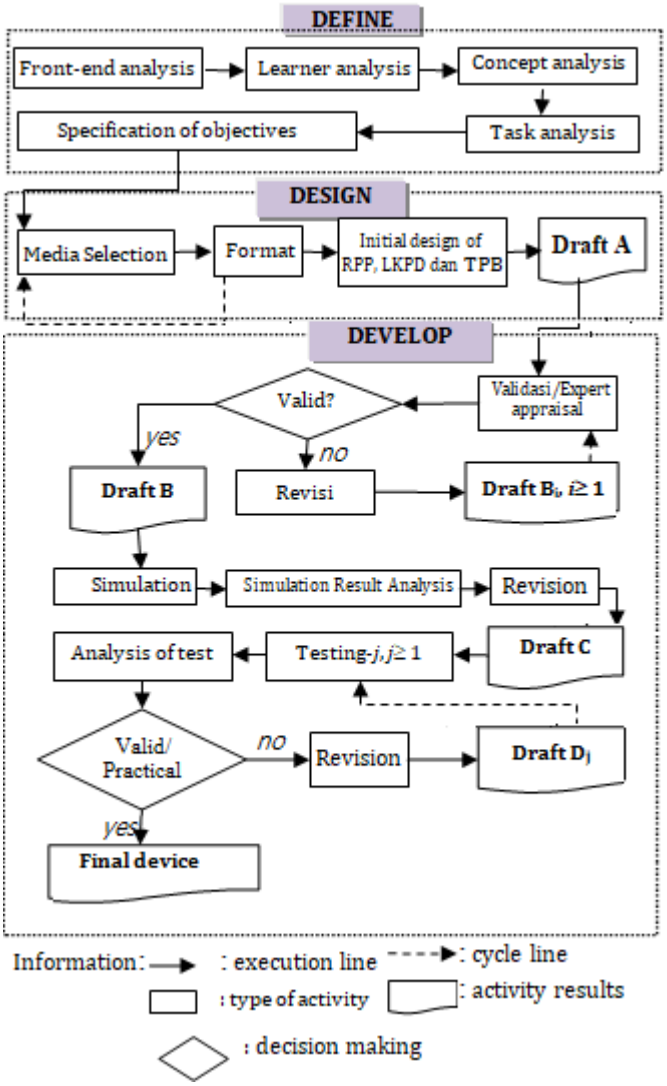

Figure 1: Description of each stage of Learning Device Development based on a modified 4 - D model

3. Results and Discussion

After passing through the Define and Design stages, the initial product is obtained which is called the initial prototype which consists of RPP, LKPD and TPB. Furthermore, Develop activities consist of validation and testing processes, with the following results.

(1) Validity analysis includes analysis of data resulting from validators' assessment of RPP, LKPD, and TPB. RPP Validity Analysis: Data from the assessment results from the validator is quantitative data which is converted into qualitative data to determine the validity criteria of the lesson plan. RPP is said to be valid and feasible to use if the average score of lesson plans meets the minimum valid category, namely (x) $\bar{}$ > 153.33. Based on these criteria, the results of the lesson plan validity analysis are shown in Table 3.1

Table 3.1: RPP Validity Analysis Results

Validator Score	Validation Results
1	217
2	187
Total Score	404
Average	202
Criteria	Very Valid

Based on the results of the analysis in Table 3.1, the average score is 202 which is included in the very valid category. The results of the analysis for each aspect assessed in the RPP are shown in Table 3.2.

Table 3.2: Results of the Validation Analysis of Each Aspect of the RPP

No	Rated aspect	Skor Rata - rata	Category
1	Subject identity	21, 5	Very valid
2	Formulation of indicators and formulation of objectives	25	Very valid
3	Material selection	34, 5	Very valid
4	Selection of a model or method	17	Very valid
5	Learning Activities	27, 5	Very valid
6	Selection of media / learning resources	49, 5	Very valid
7	Assessment of learning outcomes	27	Very valid

The results of the RPP validation analysis in table 3.2 show that every aspect assessed is in a very valid category.

LKPD Validity Analysis: Data from the validator's assessment results are quantitative data which is converted into qualitative data to determine the validity criteria of

LKPD. LKPD is said to be valid and feasible to use if the average score of LKPD meets the minimum valid category, namely (x) $\bar{>}$ 56.67. Based on these criteria, the results of the LKPD validity analysis are shown in Table 3.3.

Table 3.3: LKPD Validity Analysis Results

Validators	Validation Result Score
1	74
2	67.5
Total Score	141.5
Average	70.75
Criteria	Very Valid

Based on the results of the analysis in Table 3.3, the average score is 70.75 which is included in the very valid category. The results of the analysis for each aspect assessed on the LKPD are shown in Table 3.4.

Table 3.4: Results of Validation Analysis of Each Aspect of LKPD

No	Rated aspect	Average Score	Category
1	Appropriate content and materials	26	Very valid
2	Compatibility with language components	17.5	Valid
3	Compatibility with the presentation components	17	Very valid
4	Utilization of learning resources in the surrounding environment	10	Very valid

Based on the results of the LKPD validation analysis from Table 3.4, it shows that every aspect assessed is in a very valid category, except for the aspect of conformity with the linguistic component which is in the valid category. Overall it can be said that the developed LKPD reaches the very valid category.

SDG Validity Analysis: Data from the assessment results from the validator is quantitative data which is converted into qualitative data to determine the SDG validity criteria. TPB was analyzed for each item, after which the overall analysis was carried out. Each TPB item is said to be valid if it meets at least 9 of the 13 aspects assessed. TPB as a whole is said to be valid and feasible to use if the average score of TPB meets the minimum valid category, namely (x) $\bar{>}$ 151.67. Based on these criteria, the results of the TPB validity analysis are shown in Table 3.5.

Table 3.5: TPB Validity Analysis Results

Validators	Validation Result Score
1	195
2	258
Total Score	453
Average	226.5
Criteria	Very Valid

Based on the results of the analysis in Table 3.5, the average score is 226.5 which is included in the very valid category. The results of the analysis for each aspect assessed on the LKPD are shown in Table 3.6.

Table 3.6: Results of Validation Analysis of Each Aspect of TPB

No	Rated aspect	Average Score	Category
1	Conformity of learning techniques with learning objectives	54	Very valid
2	Instrument equipment	36	Very valid
3	Problem construction	90	Very valid
4	language	45	Valid

Based on the results of the TPB validation analysis from table 30, it shows that every aspect that is assessed is in a very valid category, except for the aspect of conformity with the linguistic component which is categorized as valid. Overall it can be said that the TPB that was developed reached a very valid category. After fulfilling the very valid category, empirically the questions were re - tested using a parallel method to determine their reliability. The data were taken from students who were the test subjects. From the analysis of the data obtained a correlation coefficient of 0.5773 and SEM (Standard Error Measurement) of 12.8489.

(2) Practicality Analysis: The practicality of the teaching materials developed is known from the analysis of the results of the teacher's practicality sheets, student practicality sheets, and the results of observations of the implementation of learning. The results of the practicality analysis of the product are described as follows: Data Analysis of the Practical Results of Teaching Materials by Teachers. The resulting data from the practicality of teaching materials by the teacher is quantitative data which is converted into qualitative data to determine the practicality criteria of teaching materials (RPP, LKPD and TPB). Teaching materials are said to be practical if the average score of teaching materials meets the practical minimum category, namely (x) $\bar{>}$ 57.5. Based on these criteria, the results of the practicality analysis of teaching materials are shown in Table 3.7.

Table 3.7: Results of Practicality Analysis of Teaching Materials by Teachers

Teacher	Teaching Material Assessment Score
1	89
2	90
Total Score	179
Average	89.5
Criteria	Very Practical

Based on the results of the analysis in Table 3.7, the validity of the TPB obtained an average score of 89 which is included in the very practical category. The results of practicality data analysis for each teaching material are shown in Table 3.8.

Table 3.8: Practicality Analysis Results for Each Teaching Material

Teacher	Product Score		
	RPP	LKPD	TPB
1	35	30	24
2	33	32	25
Total Score	68	62	49
Average	34	31	24, 5
Criteria	Very good	Very good	Very good

Based on the results of the practicality analysis for each teaching material from table 32, it shows that every aspect that is assessed is in the very good category so that as a whole it can be said that the teaching materials developed reach the very practical category. Analysis of Student Practical Results Data. The resulting data from the practicality of teaching materials by students is quantitative data which is converted into qualitative data to determine the practicality criteria of teaching materials (LKPD and TPB). Instructional materials are said to be practical if the average score of teaching materials meets the practical minimum category, namely (x) $\bar{>}$ 46.67. Based on these criteria, the results of the practicality analysis of teaching materials are shown in Table 3.9.

Table 3.9: Results of Practicality Analysis of Teaching Materials by Students

No	Learners	Number of Students	Teaching Material Assessment Score
1	South East Siau State Middle School 1	25	1.524
Rata - rata			60, 96

Based on the results of the analysis in table 3.9, the validity of the TPB obtained an average score of 60.96 which is included in the very practical category. The results of practicality data analysis for each teaching material are shown in Table 3.10

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Table 3.10: Practicality Analysis Results for Each Teaching Material

No	Peserta didik	Jumlah Peserta didik	Skor Penilaian Bahan Ajar	
			LKPD	TPB
1	SMP Negeri 1	25	1.025	950
Rata - rata			41	38
Kategori			Baik	Baik

Based on the results of the practicality analysis for each teaching material from Table 3.10, it shows that every aspect that is assessed is in the good category so that as a whole it can be said that the teaching materials developed reach the very practical category.

Data Analysis of the Observation Results of Learning Implementation, obtained from the results of observing the implementation of learning at each meeting. The data analysis is shown in Table 3.11.

Table 3.11: Results of Observation Data Analysis of Learning Implementation

No	Peserta didik	Skor pada Pertemuan ke -							
		1	2	3	4	5	6	7	8
1	SMP Negeri 1 Siau Timur Selatan	20	21	20	22	24	23	24	24
Persentase		80%	84%	80%	88%	96%	92%	96%	96%

Based on data analysis in Table 3.11, it can be seen that the percentage of the implementation of the learning process at each meeting reaches 80%. Overall it can be concluded that the teaching materials reach practical criteria.

(3) Product Effectiveness Analysis: The effectiveness of teaching materials developed (RPP, LKPD, and TPB) is viewed from the aspect of student achievement. Aspects of student achievement are measured based on TPB results data. Then it will be seen the percentage of individual and classical learning completeness of students. Based on the data from the results of the student achievement test, an analysis is obtained as shown in Table 3.12

Table 3.12: Results of Data Analysis of Learning Achievement Tests

No	Learners	Average value	Number of Students Reach KKM Score	Number of Students	Completeness Percentage
1	South East Siau State Middle School 1	84	22	25	88%

Based on Table 3.12, it can be seen that the percentage of completeness for class IX - 1 students of SMP Negeri 1 Siau Timur Selatan is 88%. The results of the data analysis show that many students achieve KKM in each class of more than 70%. So it can be concluded that the developed teaching materials have reached the criteria of effectiveness.

4. Conclusions and Suggestions

Based on the results of the research and discussion, the following conclusions are obtained: (1) The results of the development are products in the form of teaching materials for Middle School Geometry that utilize learning resources in the surrounding environment, which include Learning Implementation Plans (RPP), Student Activity Sheets (LKPD), and Tests Learning Achievement (TPB) which is valid, practical, and effective to use. (2) The product of SMP room geometry teaching materials by utilizing learning resources in the surrounding environment consists of RPP, LKPD, and TPB after going through the validation stage, it is concluded that the teaching materials are included in the valid criteria. (3) The product of junior high school geometry teaching materials by utilizing learning resources in the surrounding environment that is produced consists of RPP, LKPD, and TPB after going through the final stage of field trials, it is concluded that the teaching materials are said to be practical. This is based on the results of the teacher's practicality sheet showing that the product meets the very practical criteria, the results of the student's practicality sheet show that the product reaches the very practical criteria, and from the observation sheet of the implementation of learning it shows that the percentage of learning implementation is ≥ 80% for each meeting. (4) The products of junior high school geometry teaching materials by utilizing learning resources in the surrounding environment consist of RPP, LKPD, and TPB. Based on the research it was concluded that the learning tools produced were effectively used. The effectiveness of the product can be seen from the acquisition of TPB results of students in

each school that is used as a test subject showing that ≥ 70% of students have achieved the KKM score.

Some suggestions for utilization, dissemination and product development are as follows: (1) The set of teaching materials for junior high school geometry by utilizing learning resources in the surrounding environment consists of lesson plans, LKPD, and TPB which are produced which meet valid, practical and effective criteria, so that it is feasible to use for learning in the classroom. (2) The teaching material products produced can be used as references and input materials for teachers in preparing teaching materials for junior high school geometry by utilizing learning resources in the surrounding environment to be used in class learning. (3) The development of spatial geometry teaching materials that utilize learning resources in the surrounding environment is limited to materials on flat sides and curved sides, so it is recommended for other researchers to be able to develop mathematics teaching materials that utilize learning resources in the surrounding environment for other materials.

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