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Development of Cooperative Learning Tools Type Course Review Horay and Geogebra Media to Improve Spatial Thinking Skills and Mathematical Resilience of Grade VIII Students

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ABSTRACT

This study aims to investigate the improvement and development of spatial thinking skills and mathematical resilience abilities of students using cooperatively developed learning tools of the Course Review Horay and Media Geogebra type; to investigate the validity, practicability, and efficacy of cooperatively developed learning tools of the Course Review Horay and Media Geogebra type in enhancing spatial thinking skills and resilience. This type of research is development research based on the ADDIE model. 33 MTs Al-Washliyah Tembung students participated in the study. The results demonstrated that 97% of the students, or 32 out of 33, improved their spatial reasoning skills. While only 19 of 33 students, or 58%, exhibited an increase in mathematical resilience. In addition, the results indicate that this development model is more effective than conventional classroom learning models at enhancing spatial reasoning and mathematical resilience. The learning aids created using cooperative Course Review Horay type and Geogebra are valid, applicable, and efficient.

A. INTRODUCTION

Mathematical skills are one of the abilities that education participants in Indonesia can develop. In light of the fact that, according to (Gutierrez, 2017), mathematics is the monarch of science, which serves as a support for other sciences, it follows that mathematics is the most influential of the sciences. Such as engineering, health, and economic sciences, etc. Geometry is one of the mathematical subjects that is generally applicable to daily life. By studying Geometry, one is expected to develop spatial intelligence. Mathematical spatial ability is the capacity to visualize, compare, infer, determine, create, focus, and acquire knowledge from visual stimuli within a room. Student indicators must be able to express the position of spatial building elements, identify and clarify geometric drawings, visualize the shape or position of a geometric object viewed from a particular vantage point, construct and represent geometric models drawn on a flat plane within the context of space, and investigate a geometric object. (Lestari, K., E., and Yudhanegara, M., 2017).

In another sense, spatial ability is an extremely beneficial skill for enhancing student comprehension. According to the National Academy of Science (Setyaningsih, R., & Rahman, 2022), each student must develop spatial sensing skills and abilities that are essential for comprehending the relationships and properties of geometry in order to solve mathematical problems. According to (Linn, M., & Petersen, 2015), spatial abilities are mental processes involved in perceiving, retaining, remembering, creating, modifying, and communicating spatial constructs. According to (Gutierrez, 2017), there are two primary spatial abilities: spatial orientation and spatial visualization. Geometry is one of the most difficult mathematics topics for students to master in school because solving spatial geometric problems requires spatial intelligence.

In addition to having spatial reasoning abilities, students are expected to have mathematical resilience. where students must be able to demonstrate responsibility and maintain their understanding of the provided mathematics material. In general, research (Hutauruk, 2013) indicates that each student's resilience depends on the learning method or model employed. The mathematical resiliency of students who engage in Problem-Based Learning Mathematical Learning will differ from that of students who acclimate to conventional learning. This is evident from the obtained mathematical indicators of resilience. According to a number of studies concerning students' spatial abilities, students' spatial abilities are poor. According to research

(Hamiyah, 2014), spatial abilities and dispositions have a significant impact on the application of the Problem-Based Learning learning model. According to another study (Ariyanto, 2018), spatial ability is a crucial indicator of gender-based mathematical reasoning. In the meantime, initial observations conducted at the MTs. Al-Washliyah Tembung school with flat side room building materials indicate that the level of students' spatial competence remains low. This is evident from student responses such as Figure 1.

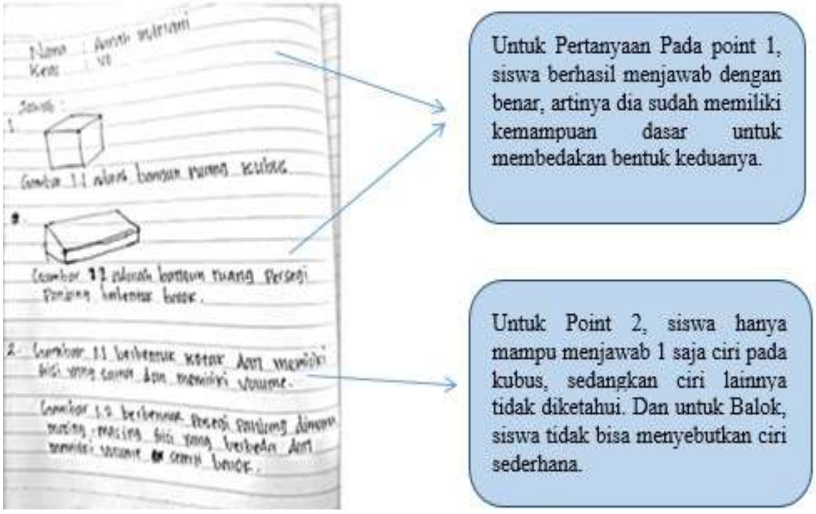

Figure 1. Student answers

On the basis of Figure 1, it is evident that students' responses to questions pertaining to the characteristics of the cubes and blocks do not precisely correspond to the existing material. On the basis of their initial observations, researchers have determined that there are problems students confront when learning mathematics in the classroom, namely a greater emphasis on the lecture method and a teacher-centered approach to education. This circumstance reduces student engagement in learning activities, which causes students to become bored and unmotivated to learn, causing students to exhibit characteristics such as: 1) tend to be passive when following the learning process; 2) lack initiative to do mathematical problems (only do what they are told); 3) do not find ideas from the LKPD teaching materials used, because they only present practice questions for students to answer; and 4) do not clearly comprehend the material. To address these issues, educators must develop effective mathematics instruction programs.

Moreover, based on observations, it was determined that the lack of variation and development in mathematics learning will make this lesson extremely rigid, so that frightening impressions will continue to appear in the personalities of students when conducting mathematics lessons (Saragih, S., & Habeahan, 2014). So that the teaching and learning process, which was originally an activity of educational value (the value that arises when instructors and students interact) that has been planned prior to the execution of learning activities cannot be obtained. In the learning process, students are expected to not only have the ability to perform well on mathematics tests, but also to be able to observe changes in their attitudes toward mathematics learning. This is supported by research (Amalia., E. Surya, and S. Syahputra, 2017). Considered vital because it measures students' mathematical logical reasoning ability, mathematics' dependability is deemed essential.

Because there is no variation in the Learning Implementation Plan's development of learning aids, it can be concluded, based on the responses of students during initial observation, that there is no variation in the effectiveness of the plan, that students lack good resilience skills, which reflect a confident attitude through hard work for success, do not demonstrate perseverance in finding obstacles, and lack the desire to discuss, reflect, and conduct research. This recalcitrant attitude, which cannot be evaluated when conditions are monotonous and rigid during the learning process, prevents students from exploring the provided material (Eviyanti, Y. C., Surya, E., Syahputra, E., and Simbolon, 2017).

To overcome this, the teacher has prepared a Learning Implementation Plan properly in accordance with the needs of the class and the demands of the times. Teachers and students must prepare themselves in the practice of teaching and learning (Simamora, R. E., Saragih, S., &; Hasratuddin, 2018). In preparing for the teaching and learning process for teachers, namely preparing activities that include planning, implementing activities to evaluation to achieve certain goals. Formulating learning planning in the teaching and learning process is closely related to the preparation of learning tools. Based on (Kemendikbud., 2013) regarding the standards of the primary and lower secondary education process, the preparation of learning tools is part of learning planning (Darda S. and Adi S, 2013).

Mathematics is one of the subjects requiring the creation of educational tools in classrooms. (Hasratuddin, 2015) Mathematics is a universal science that underpins the development of modern technology, plays an important role in a variety of disciplines, and promotes the expansion of human thought. The instructional instruments serve as a guide for instructors in the classroom, laboratory, or elsewhere. According to (Permendikbud, 2016), learning planning consists of a Syllabus, Learning Implementation Plan (RPP), and Student Worksheets (LKPD) that refer to content standards. In addition, learning planning includes the preparation of media and learning resources, evaluation instruments, and learning scenarios. Consequently, researchers choose CRH-based learning tools based on the situations and conditions that are present in students at the moment of observation. The selection of the Course Review Horay (CRH) type for learning tool development is based on the fact that CRH-type learning tools can assist students in acquiring meaningful and memorable learning through group work and playing a more active role in the classroom learning process (Soedjadi, 2014).

This viewpoint is consistent with previous research (Rusdewanti & Panca Putri, 2014) which concluded that the Course Review Horay (CRH) learning model can improve eighth-grade students' knowledge of prisms and pyramids. According to additional research (Kusfabianto, 2019), the Course Review Horay (CRH) learning model can increase student engagement and learning outcomes. In addition, according to a separate study titled Development of Strategy-Based Mathematics Learning Tools Course Review Horay arithmetic material for grade XI SMA N 4 Palopo, the development of RPP and LKPD learning tools obtained a validity score of > 0.80 (very valid) and a practicality of > 0.80 with an exceptionally useful category (Susilawati, 2021). This study's title is derived from the preceding context explanation: "Development of Cooperative Learning Tools Type Course Review Horay and Geogebra Media to Improve Spatial Thinking Skills and Mathematical Resilience of Class VIII MTs Al-Washliyah Tembung Students.

B. RESEARCH METHODS

Development research (Development Research) includes this investigation. The developmental ADDIE paradigm is used in this study. The goal of this study is to create CRH-style cooperative learning tools. MTs. Al-Washliyah Tembung carried out this inquiry in the Even Semester of the 2022–2023 Academic Year. The population of this study consists of 33 eighth-grade MTs Al-Washliyah pupils who will be given instruction on how to build a flat side room. The goal of this study is to develop a Course Review Horay-style cooperative learning tool using flat side space construction materials and Geogebra media. Utilizing the reliability and usability of educational resources, data analysis techniques are put into practice.

Validity and Usability Evaluation The validity and practicability test of research instruments is a test of the validity and practicability of the employed research instruments, which in this study includes the RPP and LKPD learning aids. The type of validity and practicality utilized in this investigation is Aiken's V content validity and practicality.

Table 1. Criteria of Coefficient of Validity and Practicality

Nilai Koefisien	Kriteria Validitas
0.81 − 1.00	Very Valid
0.61 − 0.80	Valid
0.41 − 0.60	Enough
0.21 − 0.40	Less
0.00 − 0.20	Invalid

C. RESULT AND DISCUSSION

Result

This development research intends to describe two things: (1) the development of Horay Type Course Review Cooperative learning tools improved students' spatial thinking abilities; and (2) the development of Horay Type Course Review Cooperative learning tools improved students' mathematical resilience. (3) the reliability of learning tools with the development of cooperative learning tools of the kind found in Course Review Horay; (4) the usability of learning tools with this development; and (5) the effectiveness of learning tools with this development. Each stage of the creation of the study's findings is detailed, and the outcomes are shown below.

Analysis Phase

Based on observations at MTs. Al-Washliyah Tembung, it is known that the 2013 curriculum is utilized at MTs. Al-Washliyah Tembung. At this juncture, researchers are analyzing the eighth grade MTs second semester mathematics material, particularly the Build a Flat Side Room material. The development of learning tools refers to the indicators specified in the 2013 curriculum regulation for the Basic Competencies (KD).

Design Stage

This stage's objective is to design learning aids in order to produce a prototype for the construction of flat-sided space materials using Horay's Type Course Review Cooperative method. At this stage, activities include the preparation of Student Practice Tests, the Practicality Test of Learning Tools, the selection of formats and initial design of RPP learning tools, and the development of LKPD.

Development Stage

Five individuals validated the developed learning aids, including three UNIMED mathematics education lecturers and two MTs from Al-Washliyah Tembung. The final products are depicted in the image below.

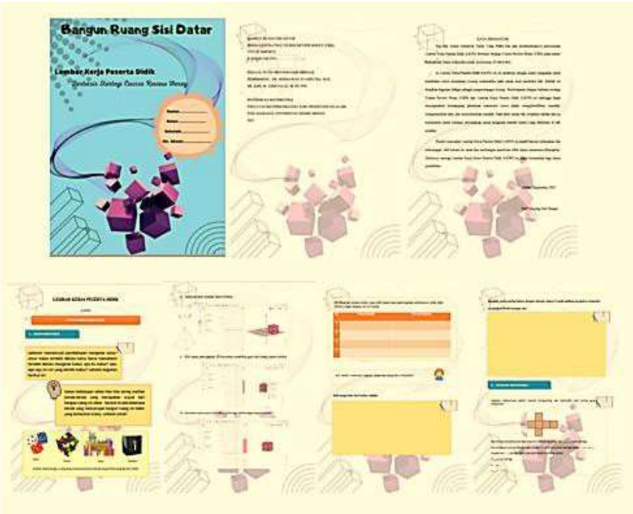

Figure 2 Products that are being developed

The results of learning validation in table 2 below:

Table 2. Recapitulation of the results of the validation of expert learning

No	Object Valued	Sum of Rate	Level Validation
1.	Learning Implementation Plan (RPP)	0.7 7	Valid
2.	Student Work Sheet (LKPD)	0.7 3	Valid
3.	Spatial Thinking Ability	0.9 7	Valid
4.	Mathematical Resilience Capability	0.9 7	Valid

The average total validity of learning instruments is derived from Table 1. The developed learning aids are "Valid" based on the validity criteria. According to the criteria for the practicality of learning tools derived from student questionnaires using Aiken's V formula, the average value of each indicator as measured by all participating students is 0.94, and the average V value derived from the V values of the aforementioned indicators is 0.94. On the basis of practicality test I and practicality test II, it can be concluded that the developed learning aids meet the practical requirements for use in the learning process.

Application

The spatial ability and resiliency test is administered twice: once before the learning activity begins, referred to as the Pre-Test, and once after two teaching and learning activity meetings, referred to as the Post-Test. The purpose of the Pre-Test and Post-Test is to determine the increase in spatial ability and student resilience resulting from the spatial construction material learning treatment. The trial outcome data are displayed in Tables 3 and 4 below:

Table 3. Percentage of Student Completeness in Solving Questions VIII-2

No	Learning Objectives	Pre-Test SCORE Percentage Learning Outcomes	Post-Test SCORE Percentage Learning Outcomes	Increased	Information
1	Students can distinguish shapes and types on Build a Flat Side Room	81,82%	100%	18,18%	Complete
2	Students can determine the part of the elements in the Flat Side Room in a problem	57,58%	84,85%	27,27%	Complete
3	Students can identify the nets in the Flat Side Room in a problem	72,73%	96,97%	24,24%	Complete
4	Students can determine the formula for volume and surface area of Build a Flat Side Space if given a problem.	60,61%	96,97%	36,36%	Complete
5	Students can use the formula for volume and surface area of Build a Flat Side Space when given a problem.	30,30%	90,91%	60,61%	Complete

Table 4. Percentage of Student Completeness in Solving Questions VIII-3

No	Learning Objectives	Pre-Test SCORE Percentage Learning Outcomes	Post-Test SCORE Percentage Learning Outcomes	Increased	Information
1	Students can distinguish shapes and types on Build a Flat Side Room	79,41%	100,00%	20,59%	Complete
2	Students can determine the part of the elements in the Flat Side Room in a problem	55,88%	97,06%	41,18%	Complete
3	Students can identify the nets in the Flat Side Room in a problem	76,47%	100,00%	23,53%	Complete
4	Students can determine the formula for volume and surface area of Build a Flat Side Space if given a problem.	55,88%	91,18%	35,30%	Complete
5	Students can use the formula for volume and surface area of Build a Flat Side Space when given a problem.	20,59%	85,29%	64,70%	Complete

Based on Tables 3 and 4, it is clear that increasing learning completeness is more effective during Trial II, as student learning outcomes scores improved by more than 75%, the time used conformed to the standards, and students responded positively to the use of this learning tool.

Evaluation Phase

Evaluation is the process of determining whether the learning process using the development of learning aids meets the anticipated research objectives. In light of this, we will examine the applicability and efficacy of learning instruments. Using teacher observation and student questionnaires, the usefulness of educational instruments is evaluated. The effectiveness of pupils can be determined by comparing the test scores of those who receive learning through the development of learning tools to those whose learning process is conducted as usual. Then, students' spatial reasoning and mathematical resiliency will improve during this phase.

a. Practical Results of Learning Tools

The results of the practicality test consisting of teacher observation and student questionnaires reveal the usefulness of the learning tools. Using Aiken's V validation formula, these two test phases will be analyzed. The results of the practicality test will indicate whether or not the developed learning aids are applicable to the classroom learning process.

Table 5. Test the practicality of activity observation by teachers

Aspects Valuation	Value Expert Validators	S	V
Opening Activities	3	2	0,67
Core Activities	3	2	0,67
Concluding Activities	4	3	1
			$\bar{x} = 0,78$

The V value obtained by aggregating the V values of the aforementioned indicators is 0.78, as shown in Table 5.

b. The Effectiveness of Learning Tools

When conducting a pre-test and a post-test in class, the average grade increase of all participants demonstrates the efficacy of the learning tools created. Following is a graphical representation of the complete pre-test and post-test scores of students' spatial mathematical skills in experimental classes VIII-2 and VIII-3.

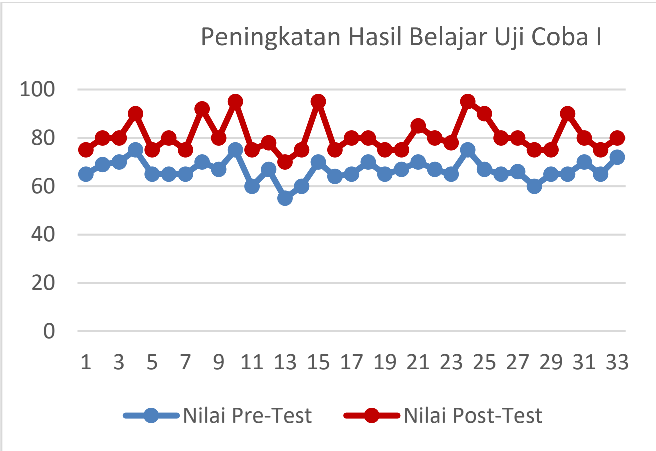

Figure 3. Graph of Pre-Test and Post-Test Values of Experimental Class VIII-2

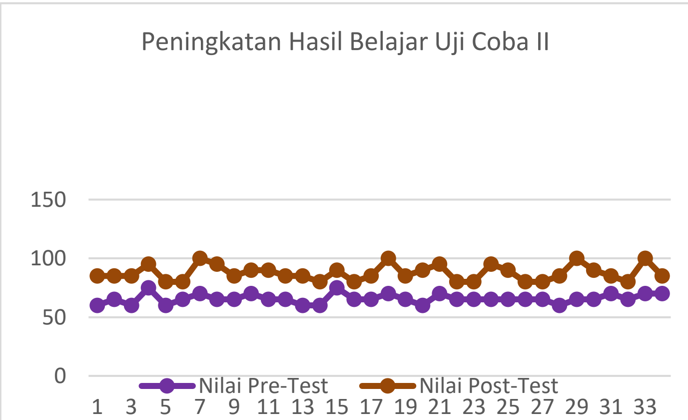

Figure 4. Graph of Pre-Test and Post-Test Values of Experimental Class VIII-3

Comparing the acquisition of pre-test and post-test scores between experimental classes Trial I in class VIII-2 and Trial II in class VIII-3, as depicted in Figures 5 and 6, it is evident that in Trial II class VIII-3, the highest post-test score attained by four students was 100. In Trial I class VIII-2, the highest post-test score attained was 95, and only three students achieved it. The results of this investigation are undoubtedly consistent with those of prior studies. Where the average post-test score of Trial II students was 7.90 points higher than those of Trial I students. In contrast, the Trial II group outperforms the control group by 15.90 points in terms of the implementation of conventional learning instruments. Or it may be stated that the chosen learning model increases students' learning value effectively.

Results of Improving Students' Spatial Thinking Skills

Only students in the experimental class will have their spatial reasoning abilities assessed. In order to conduct the analysis, pre- and post-test values will be evaluated. If the post-test score is higher than the pre-test score, the student has effectively followed the learning and improved his spatial reasoning skills. The analysis that follows focuses on enhancing students' spatial reasoning.

Table 7. Enhanced Spatial Capability VIII-2

Trial I	Student Completeness in Problem Solving				
	1	2	3	4	5
Pre-Test	27	19	24	20	10
	81,82%	57,58%	72,73%	60,61%	30,3%
Post-Test	33	28	32	32	30
	100,00%	84,85%	96,97%	96,97%	90,91%

On the basis of Table 7, it can be concluded that students' spatial ability has increased when answering 5 questions. The greatest increase was observed in question points 4 and 5.

Table 8. Enhanced Spatial Capability VIII-3

Trial II	Student Completeness in Problem Solving				
	1	2	3	4	5
Pre-Test	27	19	26	19	7
	79,41%	55,88%	76,47%	55,88%	20,59%
Post-Test	34	33	34	31	29
	100,00%	97,06%	100,00%	91,18%	85,29%

The conclusion that can be drawn from table 8 is that students' spatial ability has increased when answering five questions. The greatest increase was observed in question points 1, 2, and 5. This demonstrates that Trial II is more effective at employing cooperative learning tools of the CRH type.

Results of Students' Mathematical Resilience Ability

At this stage, the previously obtained resilience questionnaire value will be tested using Aiken's V test, which seeks to demonstrate how students' resilience thinking skills are based on learning methods used in the development of learning tools. The table below contains resilience aptitude tests.

Table 9. Resilience Capability Test Table

Question	Average Grades	∑S	V
1	3,67	2,67	0,83
2	3,35	2,35	0,78
3	3,60	2,64	0,88
4	3,56	2,55	0,85
5	3,50	2,50	0,83
	$\bar{x} = 0,84$		

The V (Aiken's) value derived above demonstrates that the use of learning tools during the learning process enables students to develop very valid resilience skills. Or, in this case, it could be said that the chosen learning model improves students' resilience.

DISSCUSSION

Improving spatial thinking skills with the development of CRH type Cooperative learning tools

The Horay Course Review approach benefits students' development of their mathematics spatial abilities and aids them in acquiring the mental fortitude and visualization abilities required to pique their curiosity and seek solutions to their problems.

Faridah, Eva (2015) stated that the results of the data analysis indicate that: (1) the mathematics comprehension ability of students who learn with the cooperative learning model of type course review horay is superior to that of students who learn with conventional learning. (2) Cooperative learning results in higher enhancement of course review than traditional learning. Students with a cooperative learning course revision model are more motivated to learn than those with a conventional learning model.

Trial I's average pre-test score was 66.70 percent, while the average post-test score was 80.70 percent, as determined by an analysis of the development of students' mathematical spatial reasoning abilities. The average student score on the pre-test increased from 65.6% to 87.5% on the post-test in Trial II. Consequently, the mean value of mathematical spatial ability rose by 21.9%. Based on the previous discussion and data analysis of students' mathematical spatial reasoning skills, it is known that CRH encourages students to assimilate the material they have learned.

Increased mathematical resilience with the development of Cooperative learning tools type Course Review Horay

The results of a data analysis of the mathematical resilience of students in the experimental class indicate that mathematical resilience exists. This is evidenced by the students' average mathematical resiliency score of 0.84. Therefore, it can be concluded that student resilience is highly valid or responsive when using the CRH-type cooperative learning instrument. This result is corroborated by research conducted by Luvy Sylviana (2018): "The results indicated a positive correlation between mathematical resilience and academic ability, with mathematical resilience contributing 48.5% to academic ability." This study demonstrates a correlation between mathematical resilience and academic performance.

Validity in the development of Horay Course Review type Cooperative learning tools

The purpose of the validity test was to identify the flaws in the initial draft of learning tools designed to address problems in Class VIII of SMP MTs Al-Wasliyah Tembung pertaining to fundamental competencies, materials, sample questions, and practice questions. Five experts comprise the team of specialists (validators) involved in the development of this device. The validation results from five validators indicated that the RPP and LKPD learning aids created by researchers were valid and could be used without modification. In addition, the five validators deemed the math spatial ability test and the math resilience questionnaire valid. Based on the pre-test and post-test questions administered to the outer sample class, the results of the trial of the mathematical spatial ability test instrument demonstrated the test's reliability.

Several factors contribute to the validity of the developed learning aids, including the fact that the LKPD and RPP meet the content's validity requirements. The preceding is consistent with Arikunto's (2013) assertion that the validity of good content is determined by a learning tool's ability to measure parallel objectives to the lesson's material or content. This content's veracity is also referred to as curriculum validity. Second, Construct validity exists for the developed cooperative learning instrument of the Horay Course Review type that incorporates Geogebra. In other words, the development of cooperative learning aids of the Horay Course Review type with the assistance of Geogebra has been consistent with mathematical concepts and indicators of spatial thinking. Daulay and Surya (2019) concur with Rusmini that the validity aspect refers to the extent to which the design of the developed device is based on the validity of the content and the validity of the construct. Therefore, it can be concluded that the created learning aides meet the valid criteria.

Practical on the development of cooperative learning tools type Horay Course Review

Components of learning aids comprising Learning Implementation Plans (RPP), Student Worksheets (LKPD), and Mathematical Spatial Thinking Ability Tests, and Student Resilience Questionnaires are practical and can be used without revision, according to the results of expert evaluation. In accordance with the principle of practicability, learning aids are structured with convenience in mind. Ease in the sense that the organized learning aids are simple to comprehend and simple to implement or use (Nieveen, 1999: 127-128).

In this research, the practicality criteria for the implementation of learning tools have also been satisfied. In the Practicality I test based on Activity Observation by the Teacher, it was deemed Practical with an average value of 0.78, while in the Practicality II test based on student questionnaires, a very practical category was attained with an average score of 0.94.

Effective in the development of Horay Course Review type Cooperative learning tools

The effectiveness of the creation of Horay's Course Review type cooperative learning tools with the aid of Geogebra was assessed based on Soemosasmito's judgment in Trianto (2009: 20). The attainment of at least 75 percent of learning objectives combined with (1) classical student learning completion, which is defined as at least 85 percent of participating students, determines the efficacy of learning. (4) When instruction and learning activities do not go above the allotted learning time, there is good student learning time attendance.

Based on findings from experimental study class in Trial I and Trial II, the value of Trial I differed by an average of 14 points due to its implementation requiring more time and the class's disorderly acceptance of the application of this CRH-type Cooperative Model. In addition to the students' response ≥75% less significant, only two queries produced the greatest increase. In contrast, the average difference between Trial I and Trial II scores was 21.9 points, with more organized classroom conditions and excellent student responses to each question ≥75%, in particular the three queries with the greatest improvement. The difference between the experimental group and the control group is six points on average. The evolution of type Horay's Course Review, aided by Geogebra, is therefore classified as Complete Effective.

D. CONCLUSION AND SUGGESTIONS

Based on the analysis results, findings, and discussion in the previous discussion, we get the following conclusions. Using developed learning tools, eighth-grade students at MTs Al-Washliyah Tembung have enhanced their spatial reasoning abilities. 61% of students demonstrated an increase in their spatial reasoning abilities. MTs Al-Washliyah Tembung eighth graders' mathematical resilience has increased in tandem with their spatial reasoning abilities. The test of the ability to consider student resilience yielded a V (Aiken's) value of 0.84, indicating that the resilience ability possessed by students was classified as capable. The learning tool or research instrument's validity demonstrates that the device used is legitimate and does not require revision. The practicality of learning tools, as measured by practicality test I and practicality test II, indicates that the learning tools developed belong to the category of practicable tools that can be used in the learning process. The practicality value is determined by Aiken's V validation, wherein the practicality test I V value is 0.78, which corresponds to legitimate criteria, and the practicality test II V value is 0.94, which corresponds to extremely valid criteria. The efficacy of learning tools as determined by a comparison of pre-test and post-test scores is 61% greater than the effectiveness of learning tools commonly used in MTs. Al-washliyah Tembung institutions.

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