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ENHANCING STUDENTS' SPATIAL ABILITY AND MATHEMATICAL RESILIENCE IN TRIGONOMETRY THROUGH THE REALISTIC MATHEMATICS EDUCATION (RME) APPROACH WITH CLINOMETER MEDIA

Gilang Fathurrohman Fattah[1*], Wahyu Lestari[2], Athar Zaif Zairozie[3]
[1,2,3]*Universitas Islam Zainul Hasan Genggong Probolinggo, Indonesia*
Email: [1]*gilangfattah15a@gmail.com*, [2]*why.lestari94@gmail.com*, [3]*zaif.athar@gmail.com*

ABSTRACT

This study aims to measure and analyze the effect of the RME approach assisted by a clinometer on students' spatial abilities and mathematical resilience in trigonometry. The sample of this study was 60 students of SMAN 1 Maron, consisting of 30 students of class XA as the control class and 30 students of class XB as the experimental class. This research used a quantitative method, a quasi-experimental design, and a purposive sampling technique. Learning sessions in this study were conducted as many as 4 meetings for 2 hours of lessons in each meeting. Data analysis was conducted using Independent Sample T-Test and N-Gain test. The tests for normality and homogeneity indicated that the data followed a normal distribution and exhibited homogeneity. The results of the Paired Sample T-Test showed a significant improvement in the experimental class, with a Sig. (2-tailed) value of 0.000 ($p < 0.01$), indicating a substantial effect on students' spatial ability and mathematical resilience. The N-Gain scores for the experimental class were 60.08 for spatial ability and 57.90 for mathematical resilience, categorizing the intervention as effective. These results indicate that using the RME approach alongside clinometer media improves students' spatial skills and mathematical resilience in trigonometry learning.

Keywords: Spatial Ability, Mathematical Resilience, Realistic Mathematics Education, Trigonometry, Clinometer.

*** Corresponding Author Email:** gilangfattah15a@gmail.com

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INTRODUCTION

Education plays a fundamental role in enhancing individuals' quality of life and serves as a benchmark for a nation's progress (Yani, 2022; Nasikhah et al., 2022). A nation can be considered advanced if it possesses quality human resources in spiritual, intellectual, and skill aspects (Pasaribu & Syahputra, 2022). he process of developing human quality and education does not solely depend on formal education systems but is also influenced by educational environments outside formal contexts (Septiana et al., 2022). Therefore, the primary focus of education is to meet students' needs by prioritizing their cognitive development and thinking abilities (Rahayu et al., 2023). In the context of education, mathematics is viewed as a discipline essential for the development of other fields (Zairozie, 2022).

Mathematics is a field that organizes understanding about structure, where characteristics or ideas are logically built upon elements that have been explained as well as those that have not been explained (Soraya et al., 2021). Mathematics is often considered a difficult field of study by many students because it requires analytical skills and deep abstract understanding. This difficulty often arises when students have to relate mathematical concepts to real phenomena, such as calculations that depend on objects that are around students. This lack of understanding of relevance is often one of the reasons why students find math difficult. In the Qur'an, for example, there are verses that explicitly connect mathematics to the calculation of time through the observation of natural phenomena, such as the alternation of day and night or the movement of the moon and sun. As Allah SWT has said:

هُوَ الَّذِيْ جَعَلَ الشَّمْسَ ضِيَاۤءً وَّالْقَمَرَ نُوْرًا وَّقَدَّرَهٗ مَنَازِلَ لِتَعْلَمُوْا عَدَدَ السِّنِيْنَ وَالْحِسَابَۗ مَا خَلَقَاللّٰهُ ذٰلِكَ اِلَّا
بِالْحَقِّۗ يُفَصِّلُ الْاٰيٰتِ لِقَوْمٍ يَّعْلَمُوْنَ ۝٥

"*He is the One Who gave the sun its brightness and the moon its light, established her phases that you may learn to compute the years and other such counts (days, weeks, months). Allah created them only to manifest the truth. He has spelled out His revelations for people who want to understand.*" (QS. Yunus:5)

The verse highlights the natural mathematical concepts present in timekeeping, navigation, and astronomy. However, despite the natural presence of mathematics in everyday life, many students struggle to grasp its abstract concepts, particularly in trigonometry. Mathematics is a science that originates from nature. In outer space, there are various celestial bodies, such as the moon and the sun. These bodies rotate on their respective axes, and from this rotation arises a discipline we know as mathematics (Supriyadi, 2021). Mathematics is the study of logic regarding shapes, arrangements, and relationships among various measurements and interconnected ideas (Rahman & Saputra, 2022). Mathematics is a subject that needs to be taught from elementary school through higher education with the goal of preparing students to apply mathematical concepts and reasoning in everyday life (Lestari et al., 2023). By studying mathematics, individuals can develop essential skills such as logical thinking, abstract reasoning, and deductive logic, which together make mathematics a critical subject that must be diligently mastered at every level of formal education (Djeni & Nasikhah, 2022).

The reality on the ground shows that mathematics education within Indonesia's educational system still does not yield satisfactory results. This is evidenced by findings from the Programme for International Student Assessment (PISA) for Indonesia in 2018, as released by The Organisation for Economic Co-operation and Development (OECD), which indicate fluctuations in students' mathematical abilities (Solihin et al., 2024). Mathematics learning has unique characteristics, including the presence of abstract objects, which can make it difficult for students to grasp mathematical lessons (Rahayu & Soleha, 2023). This negative perception arises because many view mathematics as a challenging and theoretical field filled with complex and confusing symbols and formulas, often diminishing the enjoyment that should accompany learning mathematics in school (Lestari & Andinny, 2023). One of the subjects that high school students find difficult to master in mathematics is trigonometry.

Trigonometry is one of the subjects studied in high school and is a part of mathematics that examines the relationships between the angles in triangles and trigonometric functions such as sine, cosine, and tangent (Setiawan et al., 2021). Trigonometry is often viewed as a complex field by many students. The primary reason for this perception is the numerous different formulas and difficult concepts, which can lead to challenges when studying this topic (Muslimah et al., 2023). This aligns with previous research indicating that trigonometry is frequently considered complicated by many students in mathematics classes, resulting in confusion when they need to apply it (Prastika et al., 2023). In learning trigonometry, students are required to possess the ability to visualize objects and overcome obstacles in the learning process. Thus, one factor influencing students' difficulties in studying mathematics, particularly in trigonometry, is their spatial ability and mathematical resilience.

Spatial ability in mathematics refers to the capacity to visualize, compare, hypothesize, verify, distinguish, represent, and draw conclusions from visual information within a spatial context (Yulia & Putri, 2024). Spatial ability encompasses the comprehension of spatial relationships (the capacity to discern the positioning of objects within a spatial context), reference frameworks (points of reference employed to assess the positioning of objects), projection relationships (the capacity to perceive objects from diverse viewpoints), distance preservation (the capacity to quantify the distance between two locations), social representation (proficiencies in cognitively manipulating objects to illustrate spatial relationships), and mental rotation (the capacity to envisage the rotation of objects within a spatial context) (Arifin et al., 2020). Spatial ability is a crucial skill for students, particularly in geometry, as they must be able to imagine three-dimensional shapes from various perspectives (Putra et al., 2022). This spatial ability requires higher-order thinking skills to observe and envision geometric forms. Therefore, a strong imagination is necessary (Sirri et al., 2021).

In everyday life context, the development of spatial abilities is crucial (Teapon & Kusumah, 2023). Every student needs to strive to enhance their spatial awareness, which is essential for understanding relationships and characteristics in geometry to solve mathematical challenges and situations encountered in daily life (Nst et al., 2023). Spatial abilities can help students grasp difficult and abstract concepts across various disciplines, such as mathematics, physics, chemistry, and engineering (Teapon et al., 2023). Many fields require spatial abilities to effectively apply knowledge, including astronomy, education, geography, geosciences, and psychology (Lokollo et al., 2023).

Resilience is the ability to adapt and overcome challenges in life (Sallata & Huwae, 2023). Resilience emerges from the effort to confront challenging or frightening circumstances. More specifically, resilience is the means by which an individual can achieve goals through adaptation, even when faced with risky challenges and daunting situations (Pratiwi & Yuliandri, 2022). It is the capacity of an individual to assess, cope with, and improve oneself, as well as to change from difficult experiences or sadness since every individual inevitably encounters obstacles or difficulties in their lives (Habibah et al., 2021). Mathematical resilience is a crucial concept in education, as many students still struggle and regress in learning mathematics (Ghifari et al., 2022). Mathematical resilience is the persistence and strength needed to overcome difficulties in learning mathematics (Lutfiyana et al., 2023). Resilience in learning mathematics is a positive attitude and the ability to endure when confronting mathematics lessons, which motivates students to continue learning despite challenges and difficulties (Salsabila, 2021).

Mathematical resilience encompasses an optimistic attitude involving self-confidence to achieve success through hard work, perseverance in the face of difficulties, and a willingness to engage in conversation, observation, and exploration (Imam, 2023). Students with high mathematical resilience view persistence in overcoming problems and the ability to adapt as essential in learning mathematics. They perceive mathematics as a challenge that will not lead to despair (Nurhayati & Nimah, 2023). With mathematical resilience, students can confront obstacles and challenges in learning mathematics and adjust to unfavorable and unpleasant situations, even in environments they do not prefer (Alvira et al., 2022).

In the 2022 PISA survey, Indonesia ranked 69rd out of 80 countries, with a concerning average score of only 379 compared to the international average score of 472. PISA model questions assess the application of mathematical concepts in diverse contexts, including reasoning and argumentation. PISA content includes changes and relationships in functions and algebra, as well as spatial aspects and related shapes involving patterns, properties, position, orientation and representation of objects. This indicates that Indonesian students' spatial mathematical abilities, particularly in the area of geometry, are at a very low level (Farida et al., 2021). The low PISA scores suggest that Indonesian students struggle not only with mathematical concepts but also with essential cognitive skills, such as spatial ability and resilience, which are critical for understanding trigonometry. A striking fact is that only 33.4% of students managed to answer the questions correctly. This figure reflects a serious challenge faced by the Indonesian education system in developing essential spatial abilities, which are crucial not only for mathematics but also for various fields of science and everyday life (Sundayana & Maryati, 2024).

Previous research shows that only 11.21% of students possess a high level of mathematical resilience, while 69.82% fall into the moderate category and 18.96% are categorized as low (Sirri et al., 2024). These numbers are alarming, as the majority of students still have limitations in mental resilience and the ability to recover after facing difficulties. The low level of mathematical resilience highlights the need for more effective interventions to build students' resilience and confidence in facing mathematical challenges, enabling them not only to survive but also to thrive in their understanding and mathematical skills (Sirri et al., 2024). To effectively explain mathematical concepts and ensure that students truly understand the principles of trigonometry, it is crucial to use more creative teaching methods. One learning strategy that can be employed is the Realistic Mathematics Education (RME) approach.

The Realistic Mathematics Education (RME) approach focuses on using situations related to students' daily lives in the teaching and learning process (Febrianti et al., 2024). RME emphasizes the importance of real-life situations and the surrounding environment as a starting point in the mathematics learning process (Mendrofa, 2021). The RME approach aims to encourage students to understand mathematical concepts by connecting them to problems they encounter in everyday life (Firdaus et al., 2022). Everyday issues serve as a foundation for mathematics learning, illustrating that mathematics is indeed closely related to our lives (Y. Agustina et al., 2022). RME invites students to actively engage in the process of understanding mathematics, thereby enhancing their ability to grasp mathematical concepts (Siregar, 2021). Essentially, RME utilizes realistic and familiar contexts for students, meaning the realities they experience and understand through their experiences enable them to imagine and connect with their environment-whether at school, home, or during daily activities (Puspitasari & Airlanda, 2021). In this approach, the context provided does not necessarily need to be a physically occurring real situation; it can be something easily imagined and understood by students (Agustina et al., 2021).

The primary advantage of Realistic Mathematics Education (RME) compared to other methods is its emphasis on contexts relevant to students' lives, which helps them better understand the material (Wulandari, 2021). However, a drawback of the RME approach is that students may struggle to find answers independently due to their reliance on provided information. This process can be time-consuming, particularly for students with lower abilities. Students with higher abilities may feel impatient waiting for their slower peers. Additionally, this approach requires appropriate teaching aids that align with the ongoing learning context (Sriwijaya et al., 2021). To address these limitations, integrating interactive tools such as the clinometer can enhance students' engagement and understanding, bridging the gap between theory and practice.

Clinometer is a tool used to determine the angle of elevation or depression formed between a horizontal line and the line connecting a point on that horizontal line to the top of a specific object (Haidul, 2021). The use of a clinometer is performed by two individuals: one holds the tool and focuses on the object to be measured, while the second observes, records the angle, and writes down the measurement results (Prilestari, et al., 2023). The clinometer is considered effective as a teaching aid in the mathematics learning process, particularly in trigonometry, where it functions to determine the height of an object (Noor et al., 2023).

Previous research has shown that the implementation of RME is effective in enhancing students' spatial abilities in cube and rectangular prism materials at the junior high school level (Simamora et al., 2024). This aligns with other studies indicating that students taught using the RME approach perform better in spatial ability tests compared to those in conventional classes, with average scores of 84 in the experimental class and 75.9 in the control class (Nuryami et al., 2022). In another study, the RME approach effectively improved mathematical resilience, with N-Gain scores increasing from 0.33 to 0.51, indicating a moderate level of effectiveness (Astuti et al., 2024).

Numerous previous studies have examined the Realistic Mathematics Education (RME) approach aided by media or teaching tools. However, it is challenging to find researchers who utilize mathematical resilience and spatial abilities as dependent variables of Realistic Mathematics Education (RME), which serves as the independent variable. Based on the above exposition, the aim of this study is to determine whether the Realistic Mathematics Education (RME) approach, aided by clinometer media, has an effect on students' spatial abilities and mathematical resilience in trigonometry material. This research is expected to offer an engaging and dynamic alternative for students' learning.

METHOD

This research is a quantitative study that uses Quasi-Experimental Design with a Non-equivalent Group Pretest Posttest Design research design. Involving two groups, in the experimental class received treatment in the form of RME assisted by a clinometer and in the control class conventional learning, both underwent the same pretest and posttest, namely a spatial ability test and a mathematical resilience questionnaire.

Class	Pretest		Treatment		Posttest
Experiment	O_1	→	X	→	O_2
Control	O_1	→		→	O_2

Figure 1. Research Design (Abraham & Supriyati, 2022)

The subjects of this research comprised tenth-grade learners enrolled at SMAN 1 Maron. The methodology employed for sampling in this research was purposive sampling. Among the four classes available, class X B, which included 30 students, was selected as the experimental cohort, while class X A, also comprising 30 students, was designated as the control cohort. The instruments utilized for the collection of data in this study encompassed a series of inquiries that incorporated indicators of spatial aptitude alongside a mathematical resilience questionnaire, which featured both pretest and posttest items. Teaching modules and student worksheets provide structured guidance for learning trigonometry concepts. The clinometer model used in this study is an A4 paper size printout model. Students in each group are only asked to bring scissors, string and adhesive, so that it can shorten the preparation time for the practice of using trigonometry. The instruments used underwent a validation process by two validators. The indicators used in this research are as follows:

Table 1. Indicators of spatial ability and mathematical resilience (Hendriana et al., 2019)

Spatial Ability	Mathematical Resilience

1. Capture and understand an object through the five senses 2. Visualize, position, and predict objects 3. Simplifying complex images 4. Transforming the form of things captured by the eye into other forms.	1. Show an attitude of perseverance, confidence, hard work, and perseverance in the face of problems, failures, and uncertainties. 2. Shows a desire to socialize, easily gives help, discusses with peers, and adapts to his/her environment 3. Comes up with new ideas or ways and seeks creative solutions to challenges 4. Uses experiences of failure to build self-motivation 5. Showing curiosity, reflecting, researching, and utilizing diverse sources 6. Have language skills, self-control and be aware of their feelings.

Data analysis was executed utilizing SPSS version 22. The analytical procedure encompassed the input of the mean pretest and posttest scores. The methodological framework for data analysis employed the Independent Sample T-Test to draw comparisons between the average scores recorded prior to and subsequent to the treatment within the experimental group. Furthermore, an N-gain assessment was conducted to evaluate the efficacy of the Realistic Mathematics Education (RME) approach, supplemented by clinometer media. In the data analysis procedure, prerequisite tests were imperative prior to ascertaining the magnitude of the influence derived from the treatment administered in the study. Consequently, normality was evaluated utilizing the Shapiro-Wilk test, and homogeneity was determined via Levene's test. The criteria for the N-Gain Score utilized in this research were as follows:

N-Gain Score	Criteria
< 40	Not effective
$40 - 55$	Less effective
$56 - 75$	Quite effective
> 76	Very effective

Figure 2. N-Gain effectiveness criteria (Simalungun, 2023)

The alpha significance level applied in this investigation was set at 1% or 0.01, utilizing a two-tailed test. The criteria for decision-making regarding the normality test employing the Shapiro-Wilk test were as follows: if the significance value exceeds 0.01, the data is regarded as normally distributed. In contrast, if the significance value is less than 0.01, the data is considered not to conform to a normal distribution. For the homogeneity assessment, the decision criteria stipulate that if the significance value surpasses 0.01, the variances of the data are deemed homogeneous. Conversely, if the significance value is below 0.01, the variances of the data are classified as non-homogeneous. Concerning the Independent Sample T-Test, the decision criteria indicate that if the significance value is below 0.01, the null hypothesis (H_0) is to be rejected, signifying a statistically significant difference. Conversely, if the significance value exceeds 0.01, H_0 is accepted, indicating an absence of a statistically significant difference.

RESULT

Based on research in the field that has been conducted in 4 meetings, data obtained from the results of pretest and posttest 30 students of class X B (experimental group) and 30 students of class X A (control group) at SMAN 1 Maron. To provide a concise picture and clarify the information, the data will be presented in a table. From the results of the study obtained the following data:

Table 2. Statistics of experiment and control class data

	Control Class				Experiment Class			
	Spatial Ability		Mathematical Resilience		Spatial Ability		Mathematical Resilience	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
N	30	30	30	30	30	30	30	30
Min	35	55	54	62	35	65	56	70
Max	66	85	66	83	80	90	69	97
Mean	53,06	67,03	61,72	72	55,66	80,23	63,2	82
Std. Deviation	8,58	8,71	2,99	5,75	11,57	9,27	3,34	7,58

Based on Table 2, before treatment, the average score for students' spatial abilities in the experimental class during the initial assessment (pretest) was only 55,6667. In contrast, the average score for the mathematical resilience questionnaire was at 63,2, indicating that both spatial abilities and mathematical resilience were still very low. After the treatment, the average score for spatial abilities in the posttest increased to 80,2333, while the average score for the mathematical resilience questionnaire rose to 82. This increase demonstrates that the Realistic Mathematics Education (RME) approach, supported by clinometer media, effectively enhances students' spatial abilities and mathematical resilience.

Table 3. Tests of Normality Shapiro-Wilk

	Control Class				Experiment Class			
	Spatial Ability		Mathematical Resilience		Spatial Ability		Mathematical Resilience	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Statistic	0,943	0,950	0,963	0964	0,959	0,944	0,977	0,965
Df	30	30	30	30	30	30	30	30
Sig.	0.110	0.169	0,379	0,382	0,284	0,113	0,733	0,408

Table 3 presents the results of the normality testing performed through the Shapiro-Wilk test, showing the distribution of spatial abilities among students in both the experimental and control classes, both before (pretest) and after (posttest) the intervention. As indicated in Table 3, the Shapiro-Wilk test shows that the data from the pretest and posttest scores for all variables in both classes follow a normal distribution, with a significance (2-tailed) score above 0,01. This finding confirms that the data meet the required standards for normality necessary for conducting t-tests.

Table 4. Test of Homogeneity of Variances

	Spatial Ability		Mathematical Resilience	
	Pretest	Posttest	Pretest	Posttest
Levene Statistic	1,637	0,309	0,385	2,962
df1	1	1	1	1
df2	58	58	58	58

Sig.	0,206	0,581	0,537	0,091

Based on Table 4, it is shown that the data from the pretest and posttest scores for all variables in both classes are homogeneous, with a significance (2-tailed) score above 0,01. Therefore, it can be concluded that the data used is homogeneous, allowing it to be utilized for the next stage of analysis to determine the extent of the impact of the treatment on students' spatial abilities and mathematical resilience.

Table 5. Independent Sample T-Test

	Spatial Ability		**Mathematical Resilience**	
	Pretest	Posttest	Pretest	Posttest
T	-0,988	-5,684	-2,358	-5,752
df	58	58	58	58
Mean Difference	-2,6	-13,2	-1,933	-10
Std. Error Difference	2,63	2,32	0,81	1,738
Sig.	0,327	0.000	0,022	0.000

The findings obtained from the Independent Samples T-Test, which are carefully illustrated in Table 5, strongly indicate that there is a statistically significant difference between the scores obtained in the pre-test and those recorded in the post-test. In terms of the pre-test data, the results revealed a two-tailed significance level of 0.327 for spatial ability, alongside a significance level of 0.022 for students' mathematical resilience, both of which exceeded the pre-determined significance threshold set at 0.01. Consequently, these findings lead us to conclude that the null hypothesis (H_0) is accepted, effectively signifying that there is no statistically significant difference in spatial ability and mathematical resilience among students prior to the implementation of the interventions carried out in this study.

In Table 5, the posttest values for spatial abilities and mathematical resilience show a significance (2-tailed) of 0,000 for both variables, which is lower than the significance threshold of 0,01, leading to the rejection of the null hypothesis (H_0). This evidence indicates a difference in spatial abilities and mathematical resilience among students before and after the intervention. These results demonstrate that the implementation of the Realistic Mathematics Education (RME) approach, aided by clinometer media, positively affects students' spatial abilities and mathematical resilience.

According to the findings from the Independent Samples T-Test, with degrees of freedom (df) equal to 58, a significance value of 0,005, and a critical t-value of 2,66329, the calculated t-values (5,684 and 5,752) exceed the established t-table value. Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. These findings indicate a significant difference between pretest and posttest scores, further confirming that the application of the Realistic Mathematics Education (RME) approach aided by clinometer media has an impact on students' spatial abilities and mathematical resilience.

Table 6. N-Gain Test

	Control Class		**Experiment Class**	
	Spatial Ability	Mathematical Resilience	Spatial Ability	Mathematical Resilience
Min	2,78	5	22,23	18,92
Max	62,5	57,5	88,89	91,89

Std. Error	3.211	2,778	5,203	3,697
Mean	29,0379	27,3707	60,0812	57,9018

Based on Table 6, it can be observed that the improvement in spatial abilities and mathematical resilience among students in the experimental class falls within the high category. Conversely, the increase in spatial abilities and mathematical resilience in the control class is categorized as moderate. According to effectiveness indicators, both average N-Gain scores for the experimental class are classified as moderately effective. This indicates that the Realistic Mathematics Education (RME) approach, aided by clinometer media, is quite effective in enhancing students' spatial abilities and mathematical resilience.

DISCUSSION

Learning activities in the study were conducted over four meetings, each lasting two hours. The first meeting served as a pretest to assess the spatial abilities and mathematical resilience of the students prior to intervention. The second meeting followed regular classroom procedures, distinguishing between the experimental class employing the Realistic Mathematics Education (RME) approach and the control class undergoing traditional instruction. The third meeting took place outside the classroom, facilitated by clinometers and leveraging nearby school objects for the experimental class, whereas the control class continued with conventional lessons. During this session, instructors provided explanations and guidance as students conducted outdoor observations. In the experimental class, students were divided into six groups. Each group received printed copies of the clinometer media along with worksheets. They were tasked with observing the actual heights of two objects around the school, which would later be discussed in class. Finally, a posttest was administered during the fourth meeting to evaluate the spatial abilities and mathematical resilience of students after implementing either the RME approach in the experimental class or traditional instruction in the control class.

Figure 3. Research documentation

Figure 3 illustrates the learning activities of the experimental group using the RME approach with clinometer tools. The image captures students collaborating in discussions within their school environment, applying mathematical calculations based on real-world observations. The integration of the RME approach in conjunction with clinometer media has been shown to play a substantial role in the significant enhancement of students' spatial abilities, as well as their overall mathematical resilience, thereby indicating a positive correlation between the method employed and student outcomes. Conversely, in the control class, the instructional activities are predominantly characterized by a teacher-centered approach, which inadvertently leads to a scenario where students exhibit a more passive engagement and a reduced level of active participation, consequently resulting in a comparatively lower degree of improvement in both spatial abilities and mathematical resilience when juxtaposed with the outcomes observed in the experimental group.

Analysis of pretest data on spatial ability and mathematical resilience of experimental and control class students, showed that there was no statistically significant difference in their respective cognitive competencies. This similarity can be attributed to the fact that both classes had not yet received different treatments, still under the conventional learning of the class teacher before the researcher. However, after conducting a thorough analysis of the posttest data, a clear difference was seen in the spatial ability and mathematical resilience shown by students in the experimental class, which used the Realistic Mathematics Education (RME) approach assisted by clinometer media got higher posttest scores than the conventional learning posttest results in the control class, in terms of spatial ability tests and mathematical resilience questionnaires.

Practical activities in RME encourage active learning, can give students direct experience in calculating trigonometric concepts in the real world so that it can stimulate their reasoning in different scenarios. RME learning also invites students to be active in exploration in the field, increasing students' mathematical resilience so as to generate interest, enthusiasm and a sense of perseverance in learning mathematics. While traditional methods cause passive engagement and lower conceptual retention, so that when control class students are faced with problems with scenarios that are different from the concepts taught, they will find it difficult, encouraged by conventional classes that only rely on theoretical instruction so that students become passive and result in students' mathematical resilience not developing in the desired direction.

The Realistic Mathematics Education (RME) approach encourages students to be more active, build their own knowledge, strengthen interactions among peers, and develop self-confidence, which is relevant to aspects of mathematical resilience. This aligns with previous research indicating that RME can address various indicators of weaknesses in mathematical resilience (Ekayanti et al., 2023). Another factor contributing to the differences in students' spatial abilities and mathematical resilience is that in the experimental class, during the learning process, students can directly apply trigonometric concepts using objects available in the schoolyard. This is consistent with previous research indicating that the use of clinometer tools outdoors provides opportunities for students to engage with geometry in real-life situations, thereby helping them better understand and remember spatial relationships, which positively impacts their spatial abilities. (Reichenbach et al., 2019). Based on the data analysis conducted, it can be concluded that the implementation of the Realistic Mathematics Education (RME) approach, aided by clinometer media, has a significant impact on students' spatial abilities and mathematical resilience.

CONCLUSION AND SUGGESTIONS

Research conducted at SMAN 1 Maron showed that the Realistic Mathematics Education (RME) approach assisted by clinometer media had a significant effect on students' spatial ability and mathematical resilience. Statistical analysis of the research results showed an increase in the average value when comparing the data before and after the treatment was applied. The results of the prerequisite test showed that the data were normally distributed and homogeneous, meeting the requirements to proceed to the t-test. The results of the Independent Sample T-Test in the experimental class showed a significance value (2-tailed) of 0.000 for spatial ability and 0.000 for mathematical resilience, both smaller than 0.01, which indicated a significant difference in students' spatial ability and mathematical resilience before and after treatment. The results of the N-gain test which measures the scores before and after treatment in the experimental class show a value of 60.081 for students' spatial abilities and 57.901 for students' mathematical resilience which is included in the moderately effective category. Therefore, it can be concluded from the N-gain test results that the application of the Realistic Mathematics Education (RME) approach with clinometer media is effective enough to improve students' spatial abilities and mathematical resilience.

The results showed that the Realistic Mathematics Education (RME) approach assisted by clinometer media was effective in improving students' spatial ability and mathematical resilience, so it is recommended that future research can explore different variations of the RME method to examine its impact on other aspects of mathematics learning, such as creativity and problem solving. In addition, it is important to investigate how technology integration in RME can improve students' spatial abilities and strengthen their mathematical resilience. Research should also involve various educational contexts and student characteristics to gain a more comprehensive understanding of the effectiveness of RME in different learning environments. It is suggested that further research could explore different variations of RME methods to assess their impact on other aspects of mathematics learning, including creativity and problem solving.

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