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Achievement of Mathematics Self-Concept: A Comparison of Learning Effectiveness with the Approaches of Scientific and Reciprocal Teaching

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Abstract. The self-concept of mathematics must be developed. On Circle material, experimental research with a scientific methodology and a reciprocal teaching style have been conducted. The purpose of this study was to compare how students who learned mathematics using a scientific method and students who learned mathematics using a reciprocal teaching method interacted with each other. In class VIII at one of the junior high schools in Bandung, West Java, the study's Pretest-Posttest Two Treatment Design was used. The quantitative and qualitative analysis of the research data was done using the entire sample or in detail using the high and low categories of prior mathematical knowledge. The findings demonstrated that there were no differences between students who learned using a scientific approach and students who learned using a reciprocal teaching technique focused upon Prior Mathematical Knowledge (high and low). Additionally, it was revealed by the examination of the interaction effect that there is no interaction among teaching and pupils' prior mathematical knowledge (both high and poor) and students' perceptions of themselves as mathematicians .

Keywords: Achievement · Comparison · Reciprocal Teaching · Scientific Approaches · Self-Concept

1 Introduction

The environment, experience, and parenting patterns of parents had a significant effect on the formation of one's self-concept [1]. An environment that provides a positive attitude would make children feel valuable, so that a positive self-concept develops, and vice versa. Self-concept was all perceptions about aspects of self which include physical, social, and psychological, which are formed due to past experiences and interactions with other people. Bloom suggests that self-concept was one of the determining variables in the educational process [2]. The inverse link between learning success and one's

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own perception of oneself would be seen if measurements are made on specific self-concepts, namely academic self-concepts [3]. So that in this study the academic self-concept focused more on the mathematical self-concept or mathematical self-concept in a learning process. The mathematical self-concept referred to in this study included the following components: (1) Perceptual which consisted of aspects of self-appearance; (2) Conceptual consisted of aspects of self-ability, self-confidence, and independence; (3) Attitudinal which consisted of aspects of self-meaning, pride and shame [4].

Teachers could enhanced the learning process by utilizing self-concept assessment mathematically [5]. Students with strong academic self-concept also thrived in solving mathematics test questions, and the reverse was also true [6]. Self-concept and procedural knowledge in mathematics were significantly correlated in undergraduate students [7]. Math self-concept directly influenced student learning independence during the Covid-19 epidemic [8]. The student's mathematics self-concept shall accompany the high of experience if the value of their mathematics life lesson was high, and likewise [9]. Girls and boys had dramatically different mathematical self-concepts, with boys having a significantly higher mathematical self-concept [10]. Having a positive self-concept had a big impact on how well you learn math [11]. Self-concept and success in studying mathematics had a favorable and significant relationship [12]. When children were tackling arithmetic issues, their self-concept was crucial in helping to develop their perspectives, self-confidence, and positive attitudes. The viewpoints, self-assurance, and positive attitudes of the students were influenced by their self-concept when they are solving mathematical problems [13].

Teachers often engaged students in the learning process by lecturing and also assigned practice problems; pupils merely payed attention to the teacher's explanations and complete the exercises [14]. The teacher's decision regarded the learning model to be employed in class would determine the students' success in the teaching and learning activities [15]. Compared to traditional learning models, the Missouri Mathematics Project (MMP) learning model was better suited to treatment of students who have positive or negative self-concepts [16]. In addition to MMP, there was a similar learning approach that also applies to the concept of independent learning styles, namely the scientific approach. Utilizing a scientific approach aimed to develop students' character and prepare them for the skills demands of the twenty-first century [17, 18]. Students taught utilizing the scientific approach, CTL approach, and conventional approach showed significantly different writing achievement levels [19]. The probing prompting technique and the scientific approach to learning outcomes had a very strong positive and substantial relationship [20]. Students' abilities in the areas of cognition, motor skills, and curiosity (scientific attitudes) could be enhanced by using a scientific approach [21, 22].

Self-concept had a relationship with students' reading ability, students who have dyslexia (not able to read) showed low self-concept [4]. The reciprocal teaching approach also facilitated students to be able to identify important things in reading. Therefore, the reciprocal teaching approach really supported the development of students' reading skills. An incredible level of critical thinking, reasoning, and comprehension could be enhanced by a reciprocal teaching approach [23]. The Reciprocal-Teaching approach's primary activities, collaborative learning, allowed the growth of cognitive and metacognitive strategies [24]. For diverse students who are great decoders but weaker comprehends, reciprocal instruction appeared to be a potent evidence-based strategy for comprehension improvement [25]. Students used the reciprocal teaching approach scored higher than students receiving traditional instruction in math self-concept, and these scores fell between fairly good and medium levels [26]. In terms of students' starting skills, the independent learning of mathematics by school leavers whose learning through reciprocal teaching was superior to that of learning through regular learning [27]. The Reciprocal Teaching Approach was one approach that can help students write more effectively about concepts and theorems using symbolic forms in courses on sets, kinds of connections, and functions in logic and set theory [28].

There were similarities in teaching and learning activities of teachers and students on strategies in the scientific method and the approach of reciprocal teaching, including (1) Observing (scientific approach) was similar to predicting and clarifying (reciprocal teaching approach); (2) Asking (scientific approach) was similar to questioning (reciprocal teaching approach); (3) Gathering information (scientific approach) was similar to visualizing (reciprocal teaching approach); (4) Reasoning (scientific approach) was similar to connecting and calculating (reciprocal teaching approach); (5) Communicating (scientific approach) was similar to summarizing-giving feedback (reciprocal teaching) [29]. In the experimental class, a two-party comparative case study exam was required since, given this similarity, it was impossible to decide which strategy was superior. Through this research it was hoped that learning would be created that could encouraged the achievement of mathematical self-concept.

This research was conducted in class VIII, this was in accordance with the results of the study that employing a reciprocal teaching paradigm had an impact on eighth-grade students' capacity for creative thinking in mathematics [30]. The topic applied in this research is Circle. This was because students struggle with understanding the steps involved in circle learning, such as how to calculate phi and use it in a variety of real-world situations used circle circumference [31]. This study also involved students' Prior Mathematical Knowledge (PMK). This was in accordance with the results of the study that based on students' PMK, students who learned using a scientific approach showed a greater development in mathematical higher-order-thinking skills than pupils who benefited from a reciprocal teaching strategy (high and low) [29–32]. This study's goals were to look at and describe: (1) Based on students' PMK, the attainment of the mathematics self-concept for students who receive instruction with a scientific method was contrasted to students receiving instruction with a reciprocal teaching methods (high and low); (2) the results of the interaction among scientific and reciprocal instruction, pupil PMK, and the level of their mathematical self-concept.

2 Methods

In this study was a quasi-experimental study consisting of two experimental classes [29]; [32, 33]. A scientific technique was used for the first experimental class, and a reciprocal teaching strategy was used for the second experimental class. Before being given treatment, students were divided into two groups, namely the high PMK and the low PMK. The identical pre-scale and post-scale of the mathematical self-concept questionnaire were administered through both experiment groups. Pretest Posttest Two Treatment was the study's chosen design method [34]. The dependent variable in this study was the mathematical self-concept. The scientific method and the method of reciprocal instruction were the independent variables. Student PMK acted as the predictor.

All Bandung junior high school pupils from grade 8 who were enrolled in the 2013 Curriculum served as the study's participants, because the scientific approach had been applied in the teaching and learning process. Purposive sampling was used to determine the samples at the schools that became the focus of the study. This was done to gather convenient sampling method both for experiment groups which had the same PMK depending on the teacher's considerations in the area of mathematical studies [35]. The sample of this research was students of class VIII Junior High School, this was done in accordance with Piaget's theory that class VIII pupils reach the formal operations stage between the ages of 11 and 12 years old and above, when they can think formally theoretically, think logically, and can present reasons. It was acceptable to articulate pupils' mathematical self-concepts in accordance with what they believed and felt [36].

In order to compare the success of students' mathematical self-concepts, teaching materials were created in accordance with each approach's strategies. The mathematical self-concept scale was one of the non-test instruments given before (pre-scale) and after (post-scale) treatment as an evaluation material regarding the achievement of students' self-concept in learning mathematics. This scale contained statements that include components of academic self-concept [37], namely: (1) perceptual which consisted of aspects of self-appearance; (2) conceptual which consisted of aspects of self-ability, self-confidence, independence; (3) attitudinal which consisted of aspects of self-meaning, pride and shame. The statement items in the mathematical self-concept questionnaire used a Likert scale [38]. The mathematical self-concept questionnaire was compiled and developed in a mathematical self-concept questionnaire grid consisting of 32 positive and closed statements.

Before the instrument was used, a theoretical validity test was conducted on a mathematical self-concept scale conducted by five experts from mathematics learning, linguistics, counseling guidance, evaluation experts, and mathematics teachers. Furthermore, a readability test was carried out by students of SMP Class IX in the same school as the research subject. The Q-Cochran test was then used to examine the theoretical validity results. The result was that the validators give the same scale on the theoretical validity of the mathematical self-concept questionnaire. So it could be said that this mathematical self-concept questionnaire fulfilled theoretical validity. Based on the results of the same scales and opinions/inputs from several experts, it was decided that from the 40 statements, it could be continued to the empirical validity test, which of course the statements had to be corrected/revised before being tested empirically.

Empirical trials were carried out on class students who had the same characteristics as the research subjects [38], namely 33 students of class VIII SMP in Bandung. The institution was the same as the one where the study's focus was located, but not the class that was the subject of the research. A statement item was said to be valid if it was able to express something that was measured by the questionnaire [39]. The process of calculating the validity of items in a mathematical self-concept questionnaire used SPSS software Version 22.0 for Windows, namely the Corrected Item-Total Correlation column [40]. From the results of SPSS, it could be concluded that the total items that become research instruments in the mathematical self-concept questionnaire were 32 statement items, consisted of 28 valid items and four items from statements that had been revised beforehand. Furthermore, the 32 statement items were used to measure students' mathematical self-concepts. Then proceed with a reliable test using the Gutman Split-Half Coefficient correlation. The results of the analysis indicate that the mathematical self-concept questionnaire had met adequate characteristics to be used in research (reliable).

Quantitative information was gathered for this study, namely pre-scale and post-scale data on a mathematical self-concept scale. The following steps were taken during the quantitative data analysis: Initially, groups of pupils were formed based on PMK, namely high PMK and low PMK through consideration of the teacher's math scores in the previous lesson, namely grade VIII grade report cards. The second step was to grade the students' responses just on pre-scale & post-scale of their mathematical self-concepts using the answer sheet and scoring criteria that were employed. Using Microsoft Excel's Successive Interval Method (MSI), transformation was done on an interval scale. Furthermore, the mathematical self-concept scores were grouped into three criteria, namely high, medium, and low [41]. The third stage was to present descriptive statistics using the Weiner model which consisted of a pre-scale and a post-scale mathematical self-concept.

The fourth stage was to perform a normality test using the Saphiro-Wilk statistical test assisted by SPSS-22.0, because the data was less than 50 in each class (small sample) and was the best normality test compared to other normality tests [42]. The Levene's test was used in the fifth phase to examine the homogeneity of variance. The hypothesis was put to the test at the sixth step. If the data were normal and homogeneous, hypothesis testing was performed using a t-test with an independent sample t-test (2-tailed). The hypotheses proposed for the two-mean difference test on the mathematical self-concept post-scale data in the two experimental groups were:

H_0: $\mu_1 = \mu_2$; there was no difference in the average data between experimental group 1 and experimental group 2

H_1: $\mu_1 \neq \mu_2$;there was a difference in the average data between the experimental group 1 and the experimental group 2

However, if the data was normal but not homogeneous, it was continued with the t test. Meanwhile, if the data was not normal, a non-parametric test, the Mann-Whitney test, was applied for the hypothesis test. Furthermore, to determine whether or not there was an interaction effect, the two-way ANOVA test was carried out. With the hypothesis were:

$$H_0 : (\alpha_1\beta_1) = (\alpha_1\beta_2) = (\alpha_2\beta_1) = (\alpha_2\beta_2)$$

there was an interaction effect between learning and students' PMK on mathematical self-concept

H1: There is at least one inequality;

there was no interaction effect between learning and students' PMK on mathematical self-concept

If the data did not meet the assumptions of the two-way ANOVA test, namely the normality test and/or homogeneity test, then the data was analyzed descriptively. The reason behind this was that there was no adequate non-parametric option to examine the impact of interaction [43].

3 Results and Discussion

Calculation of students' mathematical self-concept achievement was measured using the following mathematical self-concept post-scale data.

Overall, Table 1 presented the average score of the post-scale mathematical self-concept students of scientific approach (experiment 1) was lower than the teaching method of reciprocal (experiment 2). As determined by the high and low PMK criteria, they share the same post scale average value, with experimental class 1 being inferior than experimental class 2. The average post-mathematics self-concept scale for every experimental class was also shown to be smaller on average the smaller the student's PMK level. There has not been a significant difference in the post-scale mean scores. The best mathematical self-concept between both the two different experimental classes must be determined using a mean difference test. The following hypothesis was tested by analyzing the post-scale data on mathematical self-concept: "there was a difference in the achievement of mathematical self-concept between students who were given a scientific approach and those who were given a reciprocal teaching approach based on students' PMK (high and low)".

The variance of both the two different data classes was subjected to normality and homogeneity testing in order to choose the best statistical test. The normality test for the distribution of the post-scale self-concept scores was mathematically tested using the Saphiro-Wilk as follows (Table 2).

Based on the normality test above, it could be seen that all significance values for high PMK, low PMK, and overall PMK in each class using a scientific method (1) and classes using a method of reciprocal teaching (2) were more than $\alpha = 0.05$, this means that H_0 was accepted, meaning that all post-test data the mathematical self-concept scale, both high PMK and low PMK along with the overall PMK were normally distributed, so that further homogeneity tests could be carried out on each of the post-scale data. The mathematical self-concept post-scale data on high PMK, low PMK, and overall PMK were tested for homogeneity using Levene's test as follows.

Table 3 given the same conclusion, namely the significance value for high PMK, low PMK, and overall PMK more than $\alpha = 0.05$. This means that H0 was accepted,

Table 1. Recapitulation of Student's Mathematical Self-Concept Post-Scale Data

Student PMK	Mathematical Self-Concept Post-Scale					
	Experiment 1			Experiment 2		
	$\bar{x}$	s	n	$\bar{x}$	s	n
High	101.5564	13.76495	9	113.7762	15.94404	15
Low	108.3507	14.63166	21	110.9310	13.19920	17
Whole	106.3124	14.48938	30	112.2647	14.38074	32

Table 2. Self-Concept Post-Scale Normality Test Based on PMK

PMK	Class	Shapiro-Wilk		Conclusion H_0
		Statistics	Sig.	
High	1	0.944	0.629	H_0 was accepted
	2	0.957	0.635	H_0 was accepted
Low	1	0.967	0.660	H_0 was accepted
	2	0.929	0.205	H_0 was accepted
Whole	1	0.983	0.908	H_0 was accepted
	2	0.980	0.792	H_0 was accepted

H_0: Normally distributed data

Table 3. Self-Concept Post-Scale Homogeneity Test Based on PMK

PMK	Levene Statistic	Sig.	Conclusion H_0
High	0.125	0.727	H_0 accepted
Low	0.022	0.883	H_0 accepted
Whole	0.001	0.980	H_0 accepted

H_0: There is no difference in variance between the two groups

meaning that there was no difference in variance between the two experimental classes (the variance is homogeneous), meaning that the post-scale mathematical self-concept data on high PMK, low PMK, and overall PMK meet the assumptions of the parametric test, so that the mean gap test was conducted using a t test. The post-scale data again for mathematics self-concept yielded the following average difference test findings.

Overall, Table 4 explained that the value of Sig. More than $\alpha = 0.05$, this means that H_0 was accepted, meaning that there was no significant difference to the post-scale mathematical self-concept. The same thing also applied to high PMK and low PMK, i.e. each significance value for high PMK and low PMK was more than $\alpha = 0.05$, this

Table 4. The Results of the Average Difference Test of Mathematical Self-Concept Post-Scale Data Based on PMK

PMK	Average ($\bar{x}$)		Statistic Test	Sig.	Conclusion H_0
	Exp. 1	Exp.2			
High	101.5564	113.7762	t test	0.069	H_0 accepted
Low	108.3507	110.9310	t test	0.576	H_0 accepted
Whole	106.3124	112.2647	t test	0.110	H_0 accepted

H_0: There was no difference in the mean post-scale score for mathematical self-concept abilities.

Table 5. Composition of Students' Mathematical Self-Concept Achievement Quality

PMK	Scientific			Reciprocal Teaching		
	Self-Concept Criteria			Self-Concept Criteria		
	High	Medium	Low	High	Medium	Low
High	1	8	0	5	10	0
Low	6	15	0	7	10	0
Whole	7	23	0	12	20	0

means H_0 was accepted, meaning that the average post-mathematical self-concept scale in PMK was high, and there was also no significant difference in the low PMK. The conclusion that there was no different in hostility between mathematics self-concept pupils with such a scientific approach as well as a reciprocal teaching strategy based on student PMK may be reached based on the findings of the posttest study of mathematical self-concept (high and low). When examining the parallels between both the two classes' accomplishments in terms of mathematics self-concept, it became clear that the standard of instruction needed to be examined. The following Table shows how well each class and PMK performed in terms of their mathematical self-concept.

Table 5 illustrated that the quality of achievement of mathematical self-concept was at high and medium levels, there was not a single student whose mathematical self-concept was of low quality. Judging from the high PMK on the scientific approach, it consisted of only one high-quality student and eight medium-quality students. It was different from the reciprocal teaching approach which consisted of five high-quality students and 10 medium-quality students. In addition, if viewed from a low PMK, the group of scientific method consisted of six high-quality students and 15 medium-quality students. Meanwhile, the class with the reciprocal teaching approach consisted of seven high-quality students and 10 medium-quality students.

Two components—student PMK grouping factors and learning factors—were necessary for pupils to develop their mathematical self-concept. Therefore, Further investigation was required to ascertain whether learning factors & PMK classification influences the development of mathematics self-concept and how learning factors & PMK classification influences interact. The following hypothesis was tested by analysing the post-scale data on mathematics self-concept: "there was an interaction effect between learning (scientific and reciprocal teaching) with students' PMK (high and low) on the achievement of students' mathematical self-concept". In order to conduct the analysis and test the normality and homogeneity of the data, the two-way ANOVA test was used to test the hypotheses. The normality test for the distribution of the self-concept post-scale scores was tested using the following Saphiro-Wilk.

Table 6 gived the same final conclusion, namely the value of Sig. Both factors were more than $\alpha = 0.05$ which means H_0 was accepted. So it could be concluded that the post-scale mathematical self-concept data was normally distributed and could be continued with the homogeneity test used Levene's test. The homogeneity test of the mathematical self-concept post-scale score was presented as follows.

Table 6. Mathematical Self-Concept Post-Scale Normality Test

Factor	Class	Shapiro-Wilk		Conclusion H_0
		Statistics	Sig.	
Class	1	0.983	0.908	H_0 was accepted
	2	0.980	0.792	H_0 was accepted
PMK	1	0.965	0.549	H_0 was accepted
	2	0.968	0.332	H_0 was accepted

H_0: Data is normally distributed

Table 7. Mathematical Self-Concept Post-Scale Homogeneity Test

F	df1	df2	Sig.
.099	3	58	.960

H_0: There is no difference in variance between the two groups

Table 7 showed that the value of Sig. More than $\alpha = 0.05$, this means that H_0 was accepted, meaning that there was no difference in variance between the two experimental classes (the variance is homogeneous) and the post-scale mathematical self-concept data meet the assumptions of parametric testing, so that a two-way ANOVA test with interaction could be performed. The results of the two-way ANOVA test with interactions for the post-mathematical self-concept scale were as follows.

Table 8 illustrated that there were similarities in the final conclusions on the influence of class factors, PMK, and the effect of the interaction between the two factors. In the learning class factor, it could be seen that the significance value was more than $\alpha = 0.05$, this means that H_0 was accepted, meaning that in terms of students' attainment of their mathematical self-concepts, the learning element had little or no bearing, because it only had an effect of Partial Eta Squared value = 0.060 = 6%. The same applies to the PMK grouping factor, it could be seen that the significance value was more than $\alpha = 0.05$, this means that H_0 was accepted, meaning that the students' achievement of their mathematical self-concept was not significantly impacted by the PMK grouping

Table 8. Results of Two Paths ANOVA Post-Scale Mathematical Self-Concept

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Conc. H_0
Class	770.690	1	770.690	3.681	.060	.060	H_0 accepted
PMK	54.872	1	54.872	.262	.611	.004	H_0 accepted
Class * PMK	326.925	1	326.925	1.561	.216	.026	H_0 accepted

a. R Squared = .069 (Adjusted R Squared = .021) factor. Because it only had an effect of Partial Eta Squared value = 0.004 = 0.4%. The same thing also happened to the interaction of the two factors, the significance value was more than $\alpha = 0.05$, H_0 was accepted. This indicates that there was no interaction impact between the learning strategies utilized and the students' preexisting mathematical knowledge on the development of mathematical self-concept. On the attainment of students' mathematical self-concepts, the interaction between the learning strategies being used Prior Mathematical Knowledge (Class*PMK) only had a partial eta squared value of 0.026, or 2.6%. The interaction between the learning used and the students' prior mathematical knowledge (Class*PMK) on the achievement of students' mathematical self-concept was presented as follows.

According to Fig. 1, students who were taught in a reciprocal manner achieved higher levels of mathematical self-concept than those who were taught in a scientific manner. In the scientific class, pupils' mathematical self-concepts were more successful when their PMK was low than when their PMK was high. The low PMK student group in the group that received instruction in science demonstrated the best achievement in mathematical self-concept, and the high PMK group demonstrated the lowest achievement in this area. This showed that there had been a variation in the sequence in which students had achieved mathematical self-concept for the Circle material in the class that had received scientific instruction. Students with low PMK may perform better mathematically than those with high PMK.

The high PMK student group in a class using a reciprocal teaching method had the highest student achievement in terms of their mathematical self-concept, and the low PMK student group had the lowest. This shows that there was no change in the order of obtaining mathematical self-concept in a class using a reciprocal teaching strategy

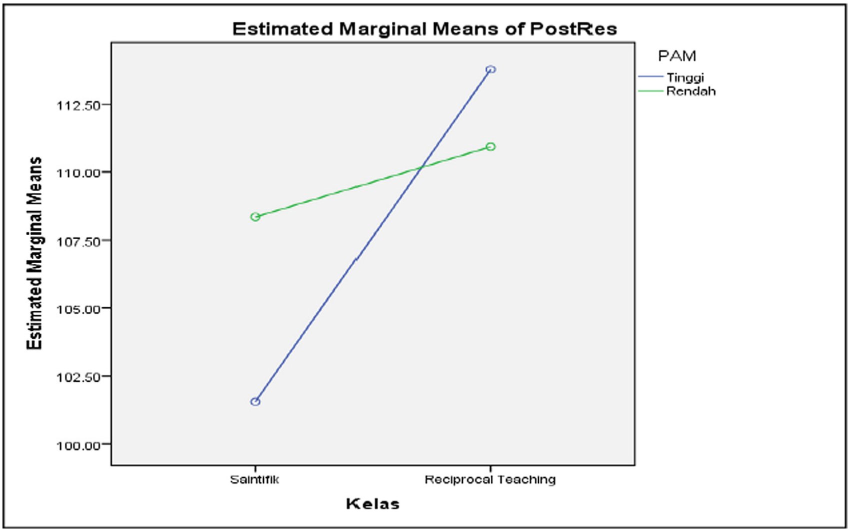

Fig. 1. A graph showing how classroom instruction and PMK affect students' achievement in math self-concept

for Circle material. High PMK pupils nevertheless outperformed low PMK kids when it came to mathematics achievement and self-concept.

In light of the explanation of Fig. 1, it was possible to draw the conclusion that the parameters utilized to categorize the students' learning classes and PMKs interacted. The interaction was shown by the point where the mean marginal lines of the low and high PMK pupils for each experiment 1st class and experiment class 2 crossed. The accomplishment of students' mathematical self-concepts, however, was not significantly impacted by this interaction, indicating that there was no joint impact of learning variables and PMK grouping factors on this outcome. This occurred because of learning factors as well as the PMK grouping factors of the students had no discernible impact on the development of the students' mathematical self-concepts. As a result, the learning strategies used in each experimental class could be used and applied universally to all students, including those in the high PMK and low PMK groups.

According to the analysis of the students' initial mathematical self-concept abilities. There were disparities between the classes using the scientific approach and the classes using the technique of reciprocal instruction. Additionally, it was noted that the two experimental classes' approximate mathematical self-concept abilities, which served as the baseline for understanding students' mathematical self-concepts, appeared to be still below the ideal score of 160, at 106.2510 for learning using a scientific method and 116.1228 for learning using a reciprocal teaching approach. Based on the resulted of observations and interviews, these different initial conditions occurred due to differences in the characteristics of students in the two experimental classes, in classes with a scientific approach students tended to be more serious and could adapted at the initial meeting when doing the pre-scale. However, it was different from a class with a reciprocal teaching approach which tended to be noisy and difficult to control, thus affected the condition of the class for other students in doing pre-scale.

Although overall students had different first mathematics self-concept abilities, the analysis of pupils' overall mathematical self-concept achievement showed that there was no difference in the achievement of mathematical self-concepts between students with a scientific approach and students with a reciprocal teaching approach. This means that the achievement of the mathematical self-concept of students who receive learning with a scientific approach was the same as students who receive learning using a reciprocal teaching approach. Compared more closely in the comparison of the typical early aptitude and success of mathematical self-concept, scientific approach throughout the class only experienced a slight increase, which was 0.0614, which means that the achievement of students' mathematical self-concept was higher than the initial ability of their mathematical self-concept. Meanwhile, the class with reciprocal teaching approach experienced a decline of 3.8581, meaning that the achievement of students' mathematical self-concept was lower than their initial mathematical self-concept ability. After being interviewed, this turned out to be caused by the influence of students' seriousness in dealing with the post-scale, there were still many of them who had not been able to make a decision on the statements in the mathematical self-concept questionnaire, so most students filled it with the same value from one statement to another.

The achievement of a mathematics self-concept founded on the PMK analysis experienced the same issue (high and low). In high & low PMK there was no significant difference in the achievement of mathematical self-concept between students with a scientific approach and students with a reciprocal teaching approach. This means that these two learnings could equally facilitated realization of one's mathematical self-concept in a class of were classified as high PMK or low PMK. Based on Table 4 and Table 5 on PMK overall the quality of achievement of mathematical self-concept was at high and medium levels, there was not a single student whose mathematical self-concept was of low quality. Overall, both classes had the same quality of achieving mathematical self-concept, namely the moderate criteria. In experimental class 1, out of 30 students, seven students were identified as having a high quality of achieving mathematical self-concept, and 23 students had moderate quality. Meanwhile, in experimental class 2, out of 32 students identified 12 students have high quality of achievement of mathematical self-concept, and 20 students were of moderate quality.

The same thing happened to high PMK, the average achievement of mathematical self-concept in both approaches was the medium criteria. In the experimental class 1, out of nine students who were categorized as high PMK, only one student was identified as having a high quality of achieving mathematical self-concept, and eight students of moderate quality. Meanwhile, in the experimental class 2, the second experimental class's 15 high-achieving students, it was identified that five students had high quality of achieving mathematical self-concept and 10 students of moderate quality. Likewise at low PMK, both approaches had an average achievement of mathematical self-concept with moderate criteria. In the experimental class 1, out of 21 students categorized as low PMK, six students had a high quality of achieving mathematical self-concept, and 15 students were of moderate quality. Meanwhile, in experimental class 2, out of 17 students categorized as low PMK, seven students had a high quality of achieving mathematical self-concept, and 10 students were of moderate quality.

Furthermore, there was also an interaction between both the components employed for the learning class as well as the students' PMK grouping, according to the examination of the impact of this interaction. The interaction was shown by the point where the mean marginal lines of high and low PMK pupils for each experiment 1st class and experiment class 2 intersected. The accomplishment of students' mathematical self-concepts, however, was not significantly impacted by this interaction, indicating that there was no joint impact of learning variables and PMK grouping factors on this outcome. This happened because of learning factors and the PMK grouping factors of students both had no significant effect on the achievement of students' mathematical self-concepts, which indicates that the learning implemented in each experimental class may be used and applicable generally to all students, including those in the high PMK and low PMK groups, on the development of students' mathematical self-concepts. According to the study's findings, this was accurate that Prior Mathematical Ability (PMA) and the instructional strategy used to raise students' Mathematical Problem Posing Ability (MPPA) did not interact [44]. A student's prior math ability had nothing to do with a teacher's self-regulated learning teaching methods [45].

In more detail, the development of pupils' mathematical self-concepts was not significantly impacted by either of these two aspects. Therefore, it could be concluded that the application of both a scientific and a reciprocal teaching style to education have an impact on students to the achievement of students' mathematical self-concepts. The similarity of the results obtained in the achievement of mathematical self-concept between learning using a scientific method and learning using a mutually beneficial teaching method was because the learning carried out in the research was only for eight meetings and it was not enough to measure students' mathematical self-concept. Therefore, students' mathematical self-concept had not been able to develop as desired. This was in line with Aristotle stating that the formation of a person's attitude or knowledge cannot develop spontaneously but would continue through a long process both individually and in groups [46]. Students' self-concept developed through certain stages due to interactions with other people in the surrounding environment [47].

The next causal factor was related to the strong desire of the individual himself, because self-concept was very dependent on the strong desire of each individual and how the individual perceives the quality of his abilities [48]. The relationship with mathematical self-concept could be concluded that mathematical self-concept was a habit/culture that takes a long time to clearly seen the influence of a learning, both scientific methods of instruction and methods of reciprocal teaching, so that mathematical self-concept could well developed in students.

4 Conclusion

This study found that the reciprocal teaching strategy based on student PMK and a scientific approach did not vary in terms of self-concept mathematical achievement (high and low). Despite the fact that the average achievement of the group with the scientific method is smaller than the group with both the reciprocal teaching methods, the class's performance under the scientific approach is comparable to the class's performance under the reciprocal teaching approach. In addition, it was also concluded that There was no interaction between scientific and reciprocal teaching learning and students' PMK (high and low) on the academic achievement of students' mathematical self-concepts'. Therefore, there was no mutual interaction between the learning variables and the PMK grouping factors on the development of the students' mathematical self-concepts. This occurred because the students' PAM grouping factor and learning component had no appreciable impact on the students' attainment of their mathematical self-concepts.

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