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# Impact of Strategy PQ4R (Preview, Question, Read, Reflect, Recite, Review) on the Ability to Solve Mathematical Problems and Confident Students SMAN 1 Sembakung

**Mahyudin [1]*, Syukrul Hamdi [2]**

[1] Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarya, Yogyakarta, Indonesia; mahyudin.2022@srudent.uny.ac.id
[2] Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarya, Yogyakarta, Indonesia; syukrulhamdi@uny.ac.id
* Corresponding Author: e-mail: mahyudin.2022@srudent.uny.ac.id

**Abstract:** This study aims to determine the effect of the application of PQ4R (Preview, Question, Read, Reflect, Recite, Review) learning strategies on the mathematical problem-solving ability and confidence of students at SMAN 1 Sembakung, Nunukan Regency. The background of this research is the low ability of students to solve mathematical problem-solving problems and their lack of confidence in facing academic challenges. The PQ4R strategy was chosen because it is considered to be able to encourage active student engagement, build deep understanding, and strengthen confidence through structured learning steps. This study uses a quantitative method with a quasi-experimental design of the pretest-posttest control group design. The research sample consisted of 73 students in grade XI who were divided into experimental and control groups at random. The research instruments include problem-solving ability tests and confidence questionnaires. The data analysis technique used t-test and MANOVA (Hotelling's Trace) after meeting the normality and homogeneity tests. The results showed that PQ4R learning strategies had a significant effect on students' mathematical problem-solving skills and confidence. The experimental group experienced a higher score increase than the control group. Thus, the PQ4R strategy can be an effective learning alternative to improve the quality of mathematics learning as well as students' affective aspects such as confidence.

**Keywords**: Active Learning; Confidence; Math Problem-Solving; PQ4R Strategy; Students

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## 1. Introduction

Education is an important process in shaping the character, insight, and skills of individuals, which ultimately contribute to improving the quality of human resources (Indriana, 2011). In the context of mathematics learning, the ability to think logically and systematically becomes the basis for learners to face the problems of everyday life (Suryani et al., 2020). One of the main competencies in learning mathematics is the ability to solve problems, that is, the ability to analyze and solve problems systematically using certain strategies (Noviantii et al., 2020). However, various studies show that this ability is still low because students tend to imitate examples without understanding the concepts in depth (Reski et al., 2019; Harefa & La'ia, 2021).

In addition, low self-confidence also hinders the success of learning mathematics. Students with high self-confidence tend to be more focused and do not give up easily, while students with low self-confidence often avoid academic challenges (Rozaini & Anti, 2017; Dewi et al., 2020). To overcome this, learning strategies are needed that are able to encourage active involvement of students, such as pq4r strategies (Preview, Question, Read, Reflect, Recite, Review) that combine reading, reflection, and repetition activities to strengthen understanding (Aisha et al., 2019; Putri et al., 2019). This strategy has proven effective in improving understanding of concepts and building confidence through structured learning (Mufidah, 2024). Therefore, this study was conducted to examine the effect of the application of pq4r strategy on problem-solving skills and confidence of students SMAN 1 Sembakung.

Based on this background, it can be identified that: (1) students ' mathematical problem solving skills are still low; (2) low self-confidence causes students to be reluctant to face challenging problems; (3) teachers have not implemented effective learning strategies to improve these abilities; (4) pq4r strategies have never been used in SMAN 1 Sembakung; (5) research on the relationship of PQ4R with confidence and problem solving are still limited; and (6) teachers do not have specific guidelines for the systematic application of PQ4R strategies (Reski et al., 2019; Lisnani et al., 2020; Harefa & La'ia, 2021).

The main objectives of this study were: (1) analyze the effect of the application of pq4r strategy on the ability to solve mathematical problems and confidence of students; (2) describe how much improvement in problem-solving ability after the application of the strategy; and (3) explain the impact of pq4r strategy on the level of confidence of students in SMAN 1 Sembakung (Mahyudin, 2025).

## 2. Literature Review

### 2.1. Math Problem Solving

Mathematical problem solving is a systematic thinking process that involves identifying problems, planning strategies, and applying logical steps to find solutions (Amam, 2017; Imam et al., 2018). This ability is not only important in the academic context, but also helps students deal with problems in everyday life (Handayani et al., 2020). In the view of Polya (1973), the problem-solving process consists of four main stages, namely understanding the problem, planning for completion, implementing the plan, and reviewing the results obtained.

Furthermore, solving mathematical problems demands the application of non-routine concepts, principles, and procedures (Lestari et al., 2021; Samo, 2017). Through this process, students develop the ability to think critically, creatively, and independently, and learn to evaluate the strategies used (Hartati et al., 2017). Therefore, teachers need to design learning that encourages the active involvement of learners in the problem-solving process, so that they get used to building their own knowledge (Lestari et al., 2021).

### 2.2 Self-Confidence

Self-confidence is an individual's belief in their ability, potential, and self-worth to face various situations and challenges (Maulana, 2022). Students who have high self-confidence will show an optimistic attitude, dare to try new things, and do not give up easily when faced with difficulties (Widyaningrum & Hasanah, 2021; Yuliati & Susianna, 2023). Conversely, students with low self-confidence tend to be pessimistic, doubt their abilities, and are easily afraid of failure (Reza et al., 2021).

Self-confidence can be fostered through learning that provides opportunities for students to argue, take responsibility, and reflect on achievements that have been achieved (Khasanah et al., 2021). Thus, self-confidence plays an important role in forming an independent person, brave in making decisions, and ready to face the challenges of learning in the future (Widyaningrum & Hasanah, 2021).

### 2.3 PQ4R (Preview, Question, Read, Recite, Reflect, Review)

PQ4R strategy is a learning method that aims to improve understanding and memory through six stages, namely Preview, Question, Read, Reflect, Recite, and Review (Aisha et al., 2019; Rijal & Sukenda, 2019). These measures encourage students to read actively, ask questions, reflect on the content of the reading, and repeat information independently, so that knowledge is easier to remember and apply in problem solving (Putri et al., 2019; Aziz & Zakir, 2022).

PQ4R strategies help students understand mathematical concepts in depth because they are actively involved in every learning process, from observing to repeating the material that has been learned (Rohman et al., 2023). This approach not only improves learning outcomes, but also fosters self-confidence as students get used to managing the learning process on their own (Supratiwi, 2024). Therefore, PQ4R has been shown to be effective in creating meaningful learning and enhancing students ' reflective thinking and mathematical problem solving skills.

## 3. Method

This study uses a quasi-experimental method with a quantitative approach, aims to examine the direct influence between the independent variable and the dependent variable. The design used is Pretest-Posttest Control Group Design, where there are two groups that were randomly selected, the experimental group that was treated with pq4r learning strategies and the control group that was not treated. This design allows researchers to compare the results before and after treatment in order to determine the effectiveness of the tested strategy (Sugiyono, 2020).

The study was conducted at SMA Negeri 1 Sembakung, Nunukan regency, North Kalimantan, with implementation in March–April 2025. The selection of this location is based on the availability of students who are relevant to the needs of research and school support

for the implementation of experiments. The population in this study is all students of Class XI SMA Negeri 1 Sembakung academic year 2024/2025. Samples were selected using random sampling techniques, then divided into two groups: the experimental group and the control group. This technique was chosen so that each student has an equal opportunity to be part of the research, so that the results are more representative (Sugiyono, 2020).

Data were obtained through questionnaires and written tests. According to Sugiyono (2020), the quality of research results is greatly influenced by the quality of data collection instruments and techniques. Questionnaires are used to measure students ' confidence levels, while tests are used to measure mathematical problem-solving skills. Both instruments use a Likert scale with five rating categories from" very good "to"very not good". The instrument grids are arranged based on indicators of confidence theory (Reza et al., 2021) and indicators of mathematical problem solving (Noviantii et al., 2020).

The Data were analyzed using multivariate analysis (one-way MANOVA) to determine the effect of pq4r strategy on two dependent variables at once, namely problem-solving ability and student confidence. Before the analysis is done, the data is tested through normality test (using Kolmogorov-Smirnov test) and homogeneity test (using Levene's Test) to ensure the conformity of data with the assumptions of parametric statistics. Hypothesis testing was conducted by Hotelling's T2 test for the first hypothesis and independent sample t-test for the second and third hypotheses. All analyzes were carried out using the SPSS version 20 program with a significance level of 0.05 ($\alpha$= 5%) (Sugiyono, 2020).

## 4. Results and Discussion

### 4.1. Respondent Data Description

The respondents of this study were all students of Class XI SMA Negeri 1 Sembakung who were experimental and control subjects. The total number of respondents as many as 73 students were selected through random sampling techniques, so that the chances of each student to be part of both groups are the same. The experimental class consisted of 36 students, while the control class consisted of 37 students. Both classes have relatively homogeneous characteristics in terms of initial academic ability based on previous math grades.

The study was conducted during regular school hours so as not to interfere with teaching and learning activities outside the school schedule. The research procedure began with the implementation of the pretest in both classes to measure the initial ability in solving mathematical problems and students confidence levels. After that, the experimental class received treatment with the application of learning strategies PQ4R (Preview, Question, Read, Reflect, Recite, Review), while the control class underwent learning with conventional problem-based methods. During the learning process, researchers also observed students ' involvement, participation, and responses in learning activities.After several meetings,

students were again given a posttest consisting of a test of mathematical problem-solving skills and a confidence questionnaire. The Data collected through the instrument were then analyzed using descriptive and inferential statistical tests to determine the effectiveness of the application of PQ4R strategy to both variables of the study. This approach follows the principles of quantitative research as explained by Sugiyono (2020), namely testing hypotheses using numerical data and measurable statistical analysis.

### 4.2. Research Results

Descriptive analysis was conducted to provide an overview of student learning outcomes in both groups before and after treatment. In the aspect of mathematical problem-solving skills, the average score of the experimental class increased from 58.27 on the pretest to 88.27 on the posttest. Meanwhile, the control class also increased although not as much as the experimental group, from 47.78 to 74.61. The increase in the value indicates that the pq4r strategy has a real contribution to the students ' ability to understand, analyze, and solve mathematical problems. On the aspect of student confidence, there was a similar increase. The average score of the experimental class rise from 98.08 to 120.62, while the control class increased from 91.31 to 102.25. These results indicate that the pq4r strategy is able to have a positive influence on students self-confidence in following mathematics learning.

Before hypothesis testing, the data is tested first to ensure that it meets the assumptions of normality and homogeneity. Based on the results of the Kolmogorov-Smirnov Test, data on problem-solving ability and confidence in both groups have a significance value above 0.05, which means that the data are normally distributed. The homogeneity test using Levene's Test also shows that the variance of both groups is homogeneous.

Furthermore, hypothesis testing was carried out using independent t-tests and MANOVA (Hotel's Trace). The results of the t-test showed that the calculated t value for problem solving ability was 49.055, greater than the table t (1.994) with significance of 0.000 < 0.05. The same thing also happened to the confidence variable, where the calculated t value was 26.381 > 1.994 and the significance value was 0.000 < 0.05. That is, there are significant differences between the experimental class and the control class in both problem-solving ability and self-confidence.

Based on the results of MANOVA test, Hotel's Trace value is 4.582 with significance 0.000 < 0.05. These results confirm that pq4r learning strategies have a significant effect simultaneously on the ability to solve mathematical problems and students ' self-confidence. Thus, the research hypothesis stating that there is a significant effect of the application of PQ4R strategy on both variables is accepted (Aisha et al., 2019; Aziz & Zakir, 2022).

### 4.3. Discussion

The findings of this study showed that the application of PQ4R strategy was able to significantly improve students ' math problem solving skills and self-confidence. These results corroborate the views of Aisha et al. (2019) and Rohman et al. (2023) that the steps in PQ4R,

from preview to review, help students understand the material in depth and foster a sense of responsibility for the learning process.

On the aspect of problem-solving skills, PQ4R strategies provide opportunities for students to actively interact with the material, formulate questions, and find solutions on their own. This is in line with Polya's (1973) problem-solving theory, which emphasizes the importance of the stages of understanding the problem, planning strategies, implementing plans, and reflecting. Through the stages of Question, Read, and Reflect, students indirectly undergo a scientific thinking process that fosters analytical skills and logical reasoning power. This finding is in line with the results of Sundari (2020) and Muna (2021) studies, which prove that PQ4R improves critical thinking skills and reduces conceptual errors in mathematics.

On the aspect of self-confidence, the pq4r strategy also makes a positive contribution because each stage of Learning contains elements of self-reflection and small successes that can increase student self-efficacy. According to Bandura (1997), the experience of success gained gradually strengthens a person's self-belief in his abilities. In this context, the success of understanding and completing tasks through the pq4r stage makes students more confident in their academic abilities. Rahmawati and Sugiarto's (2019) research also found that the pq4r strategy not only improves learning outcomes, but also fosters a confident attitude through an active and reflective learning process.

In addition, learning with the PQ4R strategy creates a collaborative and fun learning atmosphere. Reflection and recite activities encourage students to dare to express their opinions and take responsibility for their understanding. This condition also strengthens self-confidence because students feel valued and heard in the learning process. This is in accordance with the views of Mahmudah and Susanto (2021) that active involvement of students in the learning process can increase motivation and a positive attitude towards lessons.

Overall, the results of this study confirm that the pq4r strategy is effectively applied in mathematics learning because it provides a double impact, namely improving cognitive aspects (problem solving skills) and affective (self-confidence). The implementation of this strategy is expected to be an alternative for teachers in developing student-centered, creative, and reflective learning in high school, especially in mathematics.

## 5. Conclusion

Based on the results of analysis and discussion of the study, it can be concluded that the application of pq4r strategy (Preview, Question, Read, Recite, Reflect, Review) has a significant effect on the ability to solve mathematical problems and the level of confidence of students at SMAN 1 Sembakung, Nunukan Regency. The use of this strategy helps students understand the material in greater depth, be active in the learning process, and be able to relate the concepts learned to previous experiences. These results suggest that PQ4R is

effective not only in cognitive aspects, but also in building affective aspects such as learners ' self-confidence. Suggested a few things. First, teachers should attend training or workshops on the implementation of PQ4R strategies so that their implementation in the classroom is more effective and varied. Second, schools are expected to provide support in the form of media and learning resources that facilitate PQ4R-based learning. Third, the next researcher can expand the study by adding other variables such as learning motivation, learning environment, or parental support so that the results of the study are more comprehensive

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