

Effect of the PQ4R Strategy on University Students' Critical Thinking Skills and Knowledge Retention

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Abstract

The PQ4R strategy was used in this study to examine the impact on the critical thinking skills and knowledge retention of university students. The quasi-experimental pretest–posttest non-equivalent control group design was used. Students in undergraduate studies were divided into two groups: experimental and control. The experimental group was taught in accordance with the PQ4R strategy and the control group in the traditional way of presentation by lecturing. Data were collected using a standardized critical thinking skills test and a researcher-developed knowledge retention test. Independent sample t-tests and paired sample t-tests were used to analyze the data. Results revealed that students taught through the PQ4R strategy demonstrated significantly higher improvement in critical thinking skills and knowledge retention compared to those taught through traditional methods. The findings suggest that PQ4R strategy enhances deep cognitive processing and supports long-term learning at the university level. The study recommends integrating structured reading strategies into higher education classrooms to promote meaningful learning outcomes.

Keywords: PQ4R Strategy, Critical Thinking Skills, Knowledge Retention, Higher Education, Instructional Strategies

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Introduction

Colleges and universities around the globe are beginning to focus more on instilling greater cognitive skills on students to enable them to meet the intricate academic, professional, and social challenges of the twenty-first century. Among these skills, critical thinking and knowledge retention can be regarded as the crucial learning outcomes that will help students analyze the material efficiently, solve problems on their own, and use knowledge in new situations. Universities are thus moving the teaching emphasis out of the teacher-centered transmission models and towards the learner-centered approaches that encourage active learner engagement with academic content. Although this has changed, the traditional lecture-based teaching methods are still greatly applied in most university classrooms where students learn passively and memorize only in the short term without having the objective of attaining a deeper meaning. Consequently, students tend to forget conceptual information in the long term and they are also incapable of making critical thinking skills in dealing with academic literature. It has been shown that structured reading strategies are essential in facilitating increased understanding and long-term memory when it comes to knowledge because they are able to engage learners in the learning process (Sohail et al., 2025, Purnamasari et al., 2023; Baki, 2024).

Critical thinking is generally accepted as a thoughtful and reflective procedure that empowers students to assimilate information, judge arguments, and reach rational conclusions. It is regarded as one of the most significant results of the university education as it helps to maintain intellectual independence and academic success. Nonetheless, teaching critical thinking needs a systematic approach to instruction planning and application of evidence-based teaching methods other than depending on traditional teaching methods alone. The recent studies also support the idea that metacognitive instructional strategies have a considerable impact on improving the reasoning skills of students and their interest in studying the material (Favero et al., 2024).

Equally, knowledge retention is one of the major indicators of efficient learning since it shows how students can remember and use the previously acquired knowledge in various academic contexts. Instructional design and interaction of students with the learning material has a strong influence on retention. Research indicates that the structured reading strategies enhance retention by making learners process the information systematically, reflecting on it and reviewing it (Yacoub & Hussein, 2024). The PQ4R strategy, which is also referred to as Preview, Question, Read, Reflect, Recite and Review is one of the instructional strategies that have received a lot of attention in the field of educational research. This is an active learning strategy that helps in facilitating the students through a systematic chain of thought processes which help them better understand and remember academic texts. PQ4R motivates the learners to engage with the learning content meaningfully as opposed to passively reading and it enhances analytical thinking and memory. Empirical studies suggest that PQ4R enhances reading comprehension, motivation, academic achievement, and higher-order thinking of learners in various educational settings (Sohail & Iqbal, 2025; Lutfianasari, 2024).

Despite the number of studies conducted to determine the effectiveness of PQ4R in schools and secondary education levels, few studies have explored its effectiveness on the critical thinking skills and knowledge retention among university students in the same study, especially in higher education in developing countries. Thus, this raises a great necessity to explore the possibility of the PQ4R strategy as an effective instructional intervention to improve cognitive learning outcomes in university students. The current research seeks to fill this gap by investigating how the PQ4R strategy is effective in improving the critical thinking and knowledge retention among students in colleges.

Students at universities usually have problems with critical analysis of academic texts and long-term conceptual knowledge because of the use of traditional methods of lectures as the form of teaching. Such strategies are usually more focused on memorization, as opposed to a meaningful interaction with learning content. Despite the fact that the PQ4R strategy has been established as an effective metacognitive reading strategy to improve the comprehension and learning outcomes, there is a dearth of empirical evidence on its effectiveness to improve not only the critical thinking skills, but also the knowledge retention simultaneously at the university level.

Research Objectives

1. Examine the effect of the PQ4R strategy on university students' critical thinking skills.
2. Explore how the PQ4R strategy will influence the knowledge retention among university students.
3. Identify the efficacy of PQ4R strategy as a method of instructional metacognition in college classrooms.

Research Hypothesis

H₀₁: The critical thinking skills of the students taught using the PQ4R approach and those taught using the conventional teaching approaches are not significantly different.

H₀₂: There is no significant difference between the knowledge retention of students taught through the PQ4R strategy and those taught through traditional teaching methods.

H₀₃: There is no significant effect of the PQ4R strategy on university students' critical thinking skills.

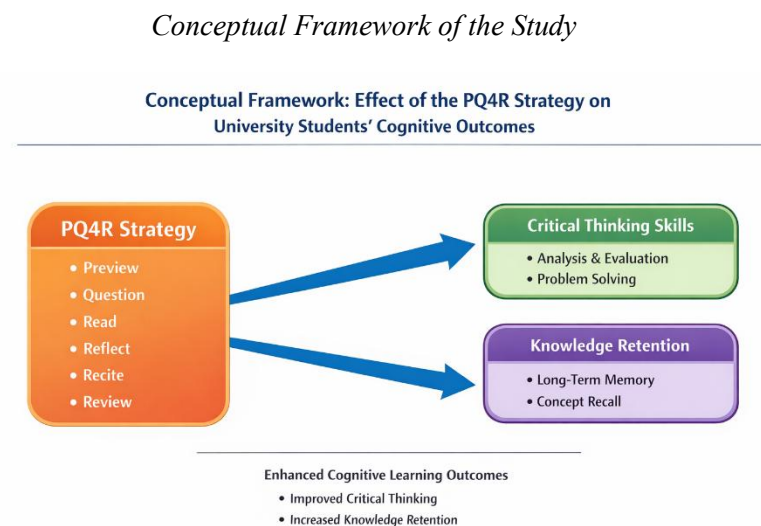
H₀₄: There is no significant effect of the PQ4R strategy on university students' knowledge retention.

Significance of the Study

To the students, the study offers them a chance to advance their critical thinking and knowledge retention abilities by the use of systematic reading schemes that advance active reading of academic contents. As a teacher, the results present a practical way of incorporating the PQ4R strategy into classroom teaching to improve the understanding and analytical thinking skills of the students. To curriculum developers, the research can be empirically utilized to support the use of metacognitive learning strategies in the instructional planning in universities. To educational researchers, the research can add to the body of existing knowledge by exploring the joint impact of the PQ4R strategy on critical thinking and retention of knowledge at the university. To policy makers, the results indicate the need to implement the learner-centered teaching methods in order to enhance the quality of higher education.

Conceptual Framework

Figure 1



The study has a conceptual framework which is founded on the assumption that higher-order cognitive learning outcomes are promoted through the use of structured metacognitive reading strategies. The PQ4R strategy is used as the independent variable, and critical thinking skills and knowledge retention are used as dependent variables in this study. PQ4R strategy encourages previewing, questioning, active reading, reflection, recitation and review all of which enhance the process of understanding and the cognitive involvement of students in the learning material. These processes aid analytical thinking and enhance memorization by frequent exposure and engagement with academic texts in a meaningful manner.

Research Methodology

The current research design was a quasi-experimental research design, namely, non-equivalent control group, pretest-posttest research design, which was used to investigate the impact of the PQ4R strategy on the critical thinking skills and knowledge retention of university students. Two intact groups of the undergraduate students were chosen. One of the classes was used as the experimental group where they were taught using the PQ4R strategy and the other group was the control group where they were taught using the traditional methods of instruction through lectures. Both groups were administered: pretests prior to the intervention. posttests after the intervention to measure differences in critical thinking skills and knowledge retention. The study can be designed as: Experimental Group: Pretest- PQ4R Intervention- Posttest. Control Group: Pretest-Traditional Teaching- Posttest. This design enabled the researcher to make comparisons on the learning gains of the groups and ascertain the success of the learning strategy.

Participant of the study

Two complete groups were selected by convenient sampling technique by the researcher. Total sample size is 60 students, each group of 30 students are comparable with respect to age, qualification, academic background and pre-subject knowledge.

Instrumentations

Two research instruments were used one is Critical thinking skills test (CTS) and other is Knowledge Retention test. Both instruments were validated by expert opinions and reliability of both instruments were .82 and .79.

Data Collection

The experimental study was conducted over eight weeks to investigate the impact of the PQ4R strategy on students' critical thinking ability and retention in higher education. In the intervention phase, the experimental group was instructed via a structured approach to implementing the PQ4R strategy, whereas the control group was instructed via traditional lecture-style instruction. Content covered, learning objectives and instructional time were the same for both groups to ensure instructional equivalence. Prior to the intervention, the researcher gave orientation lectures on the purpose and process of the PQ4R strategy to the students in the experimental group to acquaint them with the six stages of the strategy: preview, question, read, reflect, recite and review. Students were taught how to actively engage with the texts using these steps in order for them to be able to actively participate in class activities. The initial orientation session provided a clear understanding of students' role in the learning process and allowed students to apply the strategy on their own during the intervention activities.

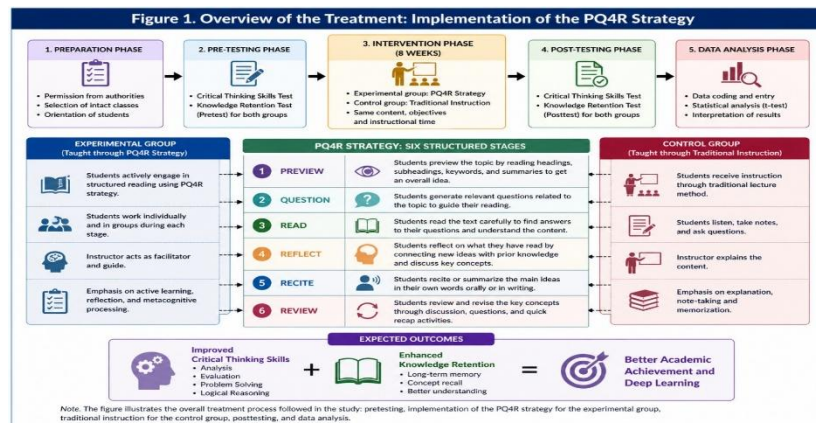
In the preview step, students were encouraged to review the headings, subheadings, keywords, learning objectives and summaries at the beginning of each lesson prior to reading the lesson content in detail. This enabled students to mobilise their existing knowledge and gain an understanding of the topic organisation. The preview task primed students' thinking for the next stage. In the question stage, students were encouraged to ask questions related to headings and key concepts identified in the preview stage. They asked questions like "what", "how" and "why" about the lesson. This stage increased motivation and drove meaningful reading by prompting students to engage with the text while looking for answers. In the read stage, students carefully read the instructional material to find answers to the questions generated in the pose stage. The researcher supported active reading by emphasising key concepts, explaining new vocabulary, and guiding students to recognise connections between concepts discussed in the material.

During the reflect stage, students critically reflected on the material they had read by linking new knowledge to existing knowledge. They engaged in peer discussion on concepts, interpreting meanings, evaluating ideas, and connections between concepts. This step helped to develop analytical skills and understanding of key concepts. In the recite phase, students orally or in writing, stated key concepts of the lesson in their own words. They recited the main ideas individually and in groups, aiding understanding, and enhancing recall. The recitation activity allowed students to structure the information, thereby improving their recall.

During the review activity, students went through the lesson again by revising key concepts, discussing key points and answering follow up questions posed by the teacher. This step enabled the reinforcement of prior learning and helped retain knowledge. During the intervention, the researcher ensured consistency in teaching with lesson plans based on the PQ4R strategy. Observations of classroom participation, engagement and completion of learning activities were done to ensure implementation. For their part, the control group learned through traditional classroom instruction based on explanation, note taking and question-answer sessions without strategy-based reading activities. After the intervention period, posttests were conducted to assess the impact of the PQ4R strategy on students' critical thinking skills and retention.

Figure 2

Data Collection (Treatment)



Data Analysis Techniques

The pre-test and post-test data of Critical Thinking Skills Test and Knowledge Retention Test were statistically analyzed using suitable descriptive and inferential statistical analysis by SPSS software. Descriptive statistics (mean scores and standard deviations) were used to describe students' performance levels in the experimental and control groups before and after the instructional treatment. These provided a description of the central tendency and spread of the data. Independent sample t-tests were used to compare pretest scores of the experimental and control groups to test for equivalence of the groups. At the end of the intervention, an independent sample t-test was further applied to test for differences in the posttest scores of the experimental and control groups in critical thinking skills and knowledge retention. Furthermore, paired sample t-test was used to compare the pretest/posttest scores of each group to see the difference in students' achievement after the intervention. The statistical test used made it possible to determine that the PQ4R strategy had a significant impact on the students' learning outcomes compared to the conventional lecturing method. Furthermore, the level of significance (α) for all statistical tests was 0.05, and the null hypotheses in the study were accepted or rejected using this level. The findings from these analyses offered empirical evidence on the impact of the PQ4R strategy on improving university students' critical thinking skills and knowledge retention, which helped in the interpretation of the study outcomes in light of the research aims and hypotheses.

Results

H₀₁: The critical thinking skills of the students taught using the PQ4R approach and those taught using the conventional teaching approaches are not significantly different.

An independent sample t-test was used to compare posttest results of the critical thinking skills of the experimental and control groups. The results showed that the students' learning outcomes were better in learning with PQ4R strategy than the students' learning outcomes in learning with the lecture method at the undergraduate level. The p value was

less than the significant value 0.05 and so the null hypothesis was rejected. This indicates that compared to traditional teaching approaches the PQ4R strategy is more effective in improving students' critical thinking skills. The p-value (.001) is less than the significance level (.05), thus the null hypothesis H_{01} is rejected. This shows that the PQ4R teaching mode has a large difference from the traditional teaching mode in stimulating students' thinking capacity.

Table 1

Independent Sample t-test for Difference in Critical Thinking Skills Between Experimental and Control Groups (Posttest)

Group	N	Mean	SD	t-value	df	Sig. (p)
Experimental (PQ4R)	30	78.45	6.82	3.41	58	.001
Control (Traditional)	30	70.12	7.15			

Table 2

Independent Sample t-test for Difference in Knowledge Retention Between Experimental and Control Groups (Posttest)

Group	N	Mean	SD	t-value	df	Sig. (p)
Experimental (PQ4R)	30	81.63	5.94	4.12	58	.000
Control (Traditional)	30	72.08	6.47			

The independent sample t-test results showed that there was a significant difference between the posttest scores of the experimental and control groups in knowledge retention. The retention scores of the students who were taught using the PQ4R strategy were greater than the retention scores of the students who were taught using conventional strategies. Thus, the null hypothesis was rejected, meaning that the PQ4R strategy has significant influence on university students' knowledge retention. The p-value (.000) is less than (.05), therefore, the null hypothesis H_{02} is rejected. This suggests that students' knowledge retention is higher when PQ4R strategy is used in teaching, compared to traditional teaching methods.

Table 3

Paired Sample t-test Showing Effect of PQ4R Strategy on Students' Critical Thinking Skills (Experimental Group)

Test	N	Mean	SD	t-value	df	Sig. (p)
Pretest	30	62.37	7.21	8.54	29	.000
Posttest	30	78.45	6.82			

A paired sample t-test was used to compare the pretest and posttest of the experimental group. There was a significant difference between students' critical thinking skills following the use of the PQ4R strategy. Therefore, the null hypothesis was rejected, which means that the PQ4R strategy has a positive impact on students' critical thinking skills. Given that the p-value (.000) is less than (.05), we reject the null hypothesis H_{03} . This demonstrates that the PQ4R strategy was effective in enhancing students' critical thinking skills.

Table 4

Paired Sample t-test Showing Effect of PQ4R Strategy on Students' Knowledge Retention (Experimental Group)

Test	N	Mean	SD	t-value	df	Sig. (p)
Pretest	30	64.18	6.75	9.21	29	.000
Posttest	30	81.63	5.94			

Paired sample t-test results showed a significant difference between the pretest and posttest scores of the experimental group in terms of knowledge retention. The results showed there was significant improvement following the PQ4R strategy. Thus, the null hypothesis was rejected. The p-value, which is (.000), is smaller than (.05), so the null hypothesis H_{04} is rejected. This means that there was a statistically significant effect of the PQ4R strategy on students' retention of knowledge.

Table 5

Effect Size (Cohen's d) for Difference in Critical Thinking Skills Between Experimental and Control Groups (Posttest)

Group	Mean	SD	Mean Difference
Experimental (PQ4R)	78.45	6.82	8.33
Control (Traditional)	70.12	7.15	

The calculated Cohen's d value (1.19) shows a large effect size, which demonstrates that the PQ4R strategy has a strong effect on students' critical thinking skills compared to traditional instruction.

Table 6

Effect Size (Cohen's d) for Difference in Knowledge Retention Between Experimental and Control Groups (Posttest)

Group	Mean	SD	Mean Difference	Cohen's d	Group
Experimental (PQ4R)	81.63	5.94	9.55	1.53	Experimental (PQ4R)
Control (Traditional)	72.08	6.47			Control (Traditional)

The Cohen's d value (1.53) demonstrates a very large effect size and that means the PQ4R strategy had a significant impact on students' knowledge retention compared to conventional teaching methods.

Conclusion

According to the study, the PQ4R strategy is effective in enhancing university students' critical thinking and retention of learning material compared to conventional lecture-based learning approaches. The stages of preview, question, read, reflect, recite and review allowed students to actively engage in their reading and helped them to better comprehend lesson content. It also helped students to organise their learning and retrieve content for posttesting. The findings also suggest that the PQ4R strategy facilitates higher-level cognitive learning outcomes by prompting active involvement, reflection and review of the lesson content. Thus, the strategy is an effective teaching strategy for promoting university students' critical thinking skills and retention of knowledge. The research findings add to the body of evidence on the benefits of structured metacognitive strategies for learning in the university classroom.

Discussion

The current study demonstrated that the PQ4R strategy had greater effects on university students' critical thinking than conventional teaching approaches. These results are in line with studies that have shown the effectiveness of metacognitive reading strategies that guide students to engage in critical thinking, evaluation, and communicate ideas meaningfully with academic texts (Purnamasari et al., 2023). The phases of previewing, questioning, reflecting, and reviewing promoted active engagement with the learning content, which led to higher-order thinking skills. The study also demonstrated improved retention of knowledge following the use of the PQ4R strategy. This result is consistent with previous research that suggests strategy-based reading instruction improves

long-term retention by encouraging deep processing and engagement with learning material (Yacoub & Hussein, 2024).

The recitation and review processes allowed students to consolidate their understanding and structure the content, which improved their retention. Additionally, the current study offered more evidence that the PQ4R strategy is more effective than traditional lecture-based teaching in enhancing students' critical thinking abilities and retention outcomes. Conventional teaching methods typically promote passive learning and rote memorisation, while PQ4R promotes active learning and reflective thinking (Lutfianasari, 2024). This engagement increases students' capacity to link existing information with new content, thereby improving their knowledge integration and understanding.

This study also supports metacognitive learning theory, where structured reading strategies help learners to regulate their learning and monitor their comprehension (Baki, 2024). The PQ4R strategy allowed students to engage in each learning stage, which enhanced their analytical and memory skills. Moreover, this study's results align with recent higher education studies that highlight the benefits of student-centered teaching strategies in enhancing meaningful learning and performance (Favero et al., 2024). Thus, the PQ4R strategy can be seen as an effective teaching strategy to enhance cognitive learning outcomes at a higher education level.

Recommendation

Based on the findings of the study, the following recommendations are proposed:

1. University teachers should incorporate the PQ4R strategy into classroom instruction to enhance students' critical thinking skills.
2. Higher education institutions should promote training workshops for teachers on the implementation of structured reading strategies such as PQ4R.
3. Curriculum developers should integrate metacognitive instructional strategies into undergraduate course design.
4. Teachers should encourage students to use structured questioning and reflection techniques while reading academic texts.
5. Future researchers should examine the effectiveness of the PQ4R strategy at different educational levels and subject areas.
6. Similar experimental studies should be conducted with larger sample sizes to enhance generalizability.
7. Future studies may investigate the impact of PQ4R on additional learning outcomes such as motivation, self-regulated learning, and academic achievement

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