

Analyzing the effect of PQ4R learning intervention on learning outcomes and retention of slow learner students across the reading phase

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Abstract

Challenges related to inadequate learning outcomes and retention among slow learner students necessitate introducing innovative solutions within the educational process. Therefore, the study analyzed the effect of PQ4R learning intervention on learning outcomes and retention of slow learners across the reading phase using the experimental method with a mixed between-within repeated measure design. The slow learner students (n=20) were selected purposively. The participants were randomly assigned to 4 groups: three experimental groups who used the PQ4R learning strategy across the reading phase (before, during, and after reading) and one control group who did not apply PQ4R across the reading phase. Learning outcomes and retention were parameters in the form of multiple-choice questions measured over three times in a pretest, posttest, and follow-up period. A mixed Between-Within ANOVA was used to analyze the significance of students' learning outcomes over time. The findings proved that PQ4R learning intervention had a significant positive effect on the learning outcomes of experimental groups over time, and participants in the experimental groups scored higher in the post-test than the control group. Moreover, PQ4R learning intervention also significantly affects the retention of students' learning outcomes over time. Hence, consistent exposure to PQ4R learning intervention over time can lead to more sustainable improvements in slow-learner students' learning outcomes.

Keywords: PQ4R, learning outcomes, retention, slow learners, General Science.

1 Introduction

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Science lessons continue to pose challenges for specific students, particularly those classified as slow learners within the category of students with special needs. Numerous studies have shown that the teaching approaches employed by educators still heavily rely on teacher-centered methods (Payne, [2018](#)). Slow learner students facing learning limitations need help grasping science materials. This is primarily due to the need for more variation in teaching methods and the failure to address slow learner students' obstacles. Slow learner students represent a category of students with below-average IQ compared to their peers (Leff, [2008](#)).

Slow learner students typically exhibit an IQ range of 85-90 and face challenges such as low learning motivation, difficulty comprehending new subjects, and poor learning memory (Shaw, [2010](#)). Thus, students need student-centered learning strategies to understand the subject matter. Learning strategies prioritizing comprehension of fundamental concepts can enhance students' understanding of learning concepts (Marantika, [2021](#)). According to Brand ([2020](#)), a study was conducted to evaluate the needs of teachers struggling to integrate science. The results showed that professional development was this subject's most commonly recommended solution. The delay in science education in elementary grades is often attributed to a lack of training, resources, and time constraints (Alalwan et al., [2020](#)). Educators have developed strategies such as PQ4R to address these challenges, emphasizing active reading and comprehension to help students develop critical thinking skills.

PQ4R strategy was first introduced in 1972 by Thomas and Robinson in their book "Improving Reading in Every Class: A Source Book for Teachers." The acronym PQ4R stands for Preview, Question, Read, Reflect, Recite, and Review. This student-centered strategy involves students in every step of the learning process. PQ4R is often used in reading comprehension learning (Martina, [2018](#); Wahyuningsih & Kiswaga, [2019](#); Wahyuningsih & Citraningrum, [2019](#)). By previewing and asking questions before reading, students reactivate their previously acquired knowledge and connect new information with what they already know. This model serves as a helpful tool for students to remember what they have read and facilitates a learning process that begins with reading activities (Setiawati & Corebima, [2018](#)). PQ4R learning strategy adopts a student-centered approach, allowing students to construct their understanding of the topic being taught (Rahmadia & Fatimah, [2021](#)).

Using the PQ4R learning strategy enhanced students' mathematical understanding and problem-solving skills. The study suggested that the PQ4R strategy can be a valuable tool for teaching and learning in mathematics (Romiyati et al., [2023](#)). The PQ4R learning method is a productive strategy for better learning outcomes for students in economics (Mamuasi & Samin, [2023](#)). Integrating the PQ4R and Team Quiz model in e-learning effectively improved students' critical thinking skills and engagement in learning. PQ4R strategy, when integrated with other learning models and technology, can be a powerful tool in promoting effective learning. (Asy'ari et al., [2023](#)).

Another classroom action research examined the effect of PQ3R (Survey, Question, Read, Recite, and Review) in enhancing the reading comprehension of second-grade students. PQ4R caused a significant difference in students' reading comprehension and activity levels (Terasne & Hafiz, [2023](#)). The previous study used the SQ4R strategy to check the improvements in students' reading comprehension of argumentation texts, which involves Survey, Question, Read, Reflect, Recite, and Review. The SQ4R method improved students' reading skills (Siregar, [2023](#)). The PQ4R proved fruitful in developing writing motivation, reading comprehension, and collaboration among students (Ansoriyah et al., [2022](#)).

PQ4R strategy can be used as a practical teaching method to improve high-level thinking skills among fourth-grade students (Al-Qawabeh et al., [2018](#)). The PQ4R strategy is effective and valid in enhancing creative thinking among school students (Sabrini et al., [2022](#)). A metacognitive

reading strategy in hybrid learning can provide students new reading experiences and perspectives (Mafazy, [2022](#)). The PQ4R strategy is efficacious in upgrading the cognitive and affective learning of the scientific sense of female students (Alshaikh, [2022](#)). The PQ4R strategy is an effective method for improving students' comprehension of editorial texts, and it can help students identify the main ideas and arguments presented in the texts (Fernando et al., [2022](#)). PQ4R strategy is an effective method, combined with crossword puzzles, to promote active learning and retention of knowledge. The PQ4R caused a significant improvement in the experimental group's learning outcomes and reading skills compared to the control group (Wijayanti & Anwar, [2022](#)).

Using PQ4R as a helpful learning method enhances students' learning outputs and reading abilities in science subjects (Dzulhikam et al., 2020). A study found significant differences in learning outcomes in participants who used the PQ4R strategy with a mnemonic-based module compared to the control group. Moreover, participants in the experimental group had a more excellent retention pace in learning than the control group (Muhibbuddin & Safrida, [2021](#)).

The fourth-grade students of the experimental group who used the PQ4R strategy scored higher in achievement tests than the control group (Tahir & Alshuon, 2023). Both the PQ4R and PQ4R-TPS learning approaches also possess the capacity to enhance students' comprehension and retention of concepts, drawing from the unique strengths of each strategy (Setiawati & Corebima, [2017](#)). PQ4R learning strategy significantly improved the retention level of reading comprehension, self-efficacy, and metacognitive thinking (Oguz & Arsalan, [2021](#)).

The PQ4R strategy enhanced students' mathematical communication ability in the experimental group than in the control group (Gardenia et al., [2019](#)). A quasi-experimental study with pretest and posttest was to determine the effectiveness of the PQ4R (Preview, Question, Read, Reflect, Recite, Review) method in improving reading comprehension skills among eighth-grade students. The results showed that the PQ4R method significantly enhanced students' reading comprehension compared to the conventional method (Fitriani & Suhardi, [2019](#)). Using the PQ4R strategy as an effective teaching strategy enhances students' reading comprehension skills (Al-Qawabeh & Aljazi, [2018](#)). Integrating PQ4R and TPS strategies can enhance students' Metacognitive skills and improve their learning outcomes in science. The study found that the intervention group's metacognitive skills improved significantly, including their planning, monitoring, and evaluation skills, compared to the control group (Setiawati & Corebima, [2018](#)).

However, the literature review conducted various research studies on the effect of PQ4R intervention on the performance and outcomes of participants. Studies have yet to be found on the impact of PQ4R learning intervention on the learning outcomes and retention of slow learner students across the reading phase. So, this study intends to analyze the effects of PQ4R learning intervention on slow learners' learning outcomes and retention across the reading phase (before, during, and after reading).

2 Material and Method

2.1 Design

The research design for this study was a mixed between-within-repeated measure design. The study involved four groups containing 20 students: an experimental group (n=15) and a control group (n=05) exposed to pretest and post-test and follow-up periods. The participants were randomly assigned to the three experimental and one control group. The study collected data from all four groups over three times (before interventions, after intervention, follow-up). All assistive material and accommodations pertinent to implementing PQ4R learning intervention were ensured in an experimental setting. The experimenter explained the purpose, nature, and distinct steps of the experiment's strategy to the participants.

2.2 Participants

The slow learner participants were taken using purposive sampling from Govt—Institute for Slow Learners Layyah, Department of Special Education Punjab, Pakistan. The participants were 20 boys of 5th grade during the academic years 2022-2023. Their IQ level was measured from 70 to 85. Their chronological age ranges from 9-14 years. All of the students were from similar socioeconomic backgrounds.

2.3 Measures

A self-devised test of the first chapter of General Science from the textbook Single National Curriculum was devised by the educator concerned fifth grade from the sample school. The pre-test consisted of 50 MCQS, covering the defined content's central area. After developing the pretest, its content validity was discussed with two educators in the same sample school who teach General Science subjects. English version of the test was used. They displayed that the test was suitable for the research. A pretest was conducted on 08 students in 5th grade to measure the test-retest reliability of the instrument. After 10 days, the same pretest was administered to the same students. Those students were not considered in the study. Their achievement score was compared. Based on a comparison of achieved scores, Product Moment Correlation was used to check the test-retest reliability of the pretest, which was .86.

The educator concerned with the fifth class devised a post-test from the second and third chapters of General Science. The test comprised a 50-item bank of MCQs covering the main areas of the chapters. The devised test was administered to another 08 students of 5th grade studying in the same institute who were not part of the study. A test-retest method was applied to the students at 10-day intervals. Its reliability was measured by Pearson Product Correlation, which was .90.

2.4 Procedure

Informed consent was sought from the students and their parents or guardians, clearly outlining the experiment's objectives, procedures, and potential risks or benefits. Privacy and confidentiality were maintained throughout the study. Equality and fairness were upheld by ensuring all participants were treated without bias, regardless of their background, abilities, or characteristics.

The participants were randomly assigned to the experimental and control group. The pretest consisted of 50 multiple-choice questions and was conducted before treatment. The experimental groups were instructed to use PQ4R intervention to learn and review material (before, during, and across reading phases) for four weeks. A multiple-choice questions-based post-test comprised of 50 items devised by the educator concerned was taken from all the groups. The scores of the post-test of the two groups were compared to analyze if the use of the PQ4R learning intervention was influential on the learning outcomes of slow learners in General Science subjects. After one week, a follow-up posttest was conducted to analyze the retention of reading material of those students who used the PQ4R learning intervention. The follow-up test scores were also compared with the post-test to investigate the retention power of PQ4R learning intervention over three times across the reading phase.

2.5 PQ4R Intervention

The PQ4R learning strategy involved 45-minute daily sessions 5 days a week for 4 weeks. The intervention period was from 31 October to 28 November 2023. The classroom with uniform material accommodations was assigned to both groups. The room temperature, ventilation system, and light were managed. The researcher-built rapport with the participants of experimental groups and encouraged them to perform the PQ4R strategy to achieve better outcomes in the subject.

The experimenter herself demonstrated each step of the PQ4R strategy to all the experimental groups. Initially, the researcher furnished students with introductory reading materials, offering guidance on discerning the central theme and establishing learning objectives (Artuti, [2023](#)).

Subsequently, the researcher underscored the significance of comprehending the text and tasks students with generating queries pertinent to the core idea, concentrating on inquiries encompassing "what," "why," "who," and "how" (Al-Waeli & Abd, 2021). Following this, students received instructions to engage with the text actively, seeking solutions to the previously raised questions (Al-Waeli & Abd, 2021). Additionally, the researcher facilitated students' contemplation of the text's content, urging them to visualize concepts and establish connections with real-world instances and models (Al Naily et al., 2019). During the training session, students were trained to rehearse each step of the PQ4R strategy in Chapter 2 of the General Science subject. Group A was instructed to apply the PQ4R learning strategy before reading the chapter. Group B was directed to use the PQ4R learning strategy while reading the chapter. Group C was trained to implement PQ4R learning intervention after reading the chapter. The control group continued to read the prescribed chapter using the traditional reading method.

2.6 Data Analysis

The Statistical Package for Social Sciences was used to analyze data and numerical results. A Mixed Between-Within ANOVA was used to analyze the main and interaction effects of group and PQ4R on learning outcomes. The outputs gave all the significant findings on the impact of the PQ4R learning intervention on participants' learning outcomes and retention across the reading phase.

3 Results

Table 1: Descriptive Statistics for the Scores of Participants across the Reading Phase (N=20)

Variables	Experimental Group		Control Group	
	M	SD	M	SD
PQ4R before reading				
T1 (Pretest)	27.2	2.28	26.60	1.14
T2 (Posttest)	29.4	2.19	26.20	1.81
T3 (Follow-up)	29.6	1.14	25.80	1.09
PQ4R during reading				
T1 (Pretest)	24.6	1.14	26.20	1.81
T2 (Posttest)	30.8	1.78	18.68	0.73
T3 (Follow-up)	30.8	1.09	19.95	1.90
PQ4R after reading				
T1 (Pretest)	28.2	1.48	24.90	1.15
T2 (Posttest)	29.6	1.51	25.62	2.27
T3 (Follow-up)	30.2	1.09	23.65	1.81

Table 1 shows the mean and standard deviation using PQ4R learning intervention across reading phases (before, during, and after reading) and over time (pretest, posttest, and follow-up). For the group A who used PQ4R learning intervention before reading has a significant positive effect on the learning outcomes over time (pretest $n = 5$, $M = 27$, $SD = 2.28$; posttest, $M = 29$, $SD = 2.19$; follow up, $M = 29$, $SD = 1.14$). Group B, which used PQ4R learning intervention during the reading phase, had a significant enhancing effect on learning outcomes over time (pretest $n = 5$, $M = 24$, $SD = 1.14$; posttest, $M = 30$, $SD = 1.78$; follow up, $M = 30$, $SD = 2.28$). Group C, who implemented PQ4R learning intervention after reading, scored higher in post-test and follow-up sessions as compared to the pretest (pretest, $n = 5$, $M = 28$, $SD = 1.48$; posttest, $M = 29$, $SD = 1.15$; the follow-up, $M = 30$, $SD = 1.09$). Hence, the findings proved that PQ4R learning intervention significantly affects the learning outcomes of slow-learner students over time across the reading phase.

Table 2: Combined ANOVA for Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	η^2
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Time	60.025	1	60.025	44.87	.000	.737
Time*Group	62.075	3	20.692	15.47	.000	.743
Error	21.60	16	1.34			

Table 2 showed there was a significant main effect of PQ4R learning intervention on learning outcomes of slow learners over time (pretest, posttest, and follow-up), $F(1, 16) = 44.8, p = 0.000 < 0.001$, partial eta squared = .737 with all experimental groups showing improvement in scores of posttest after exposing to PQ4R learning intervention. Moreover, the interaction effect of PQ4R learning intervention and time on the learning outcomes of participants were also found significant among three experimental groups $F(3, 16) = 15.47, p = .000 < 0.001$, partial eta squared = .743 proved that three groups used PQ4R before reading, during reading and after reading phase scored higher in posttest and follow up test as compared to pretest.

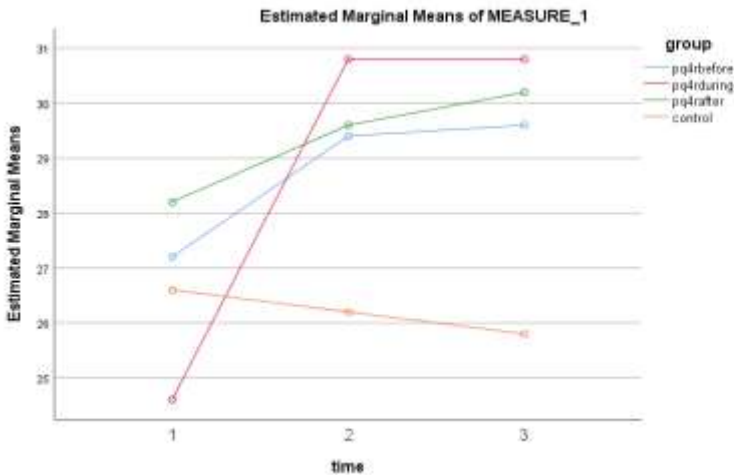
Table 3: Tests of Between-Subjects Effect

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial η^2
Intercept	47883.75	1	47883.75	8950.23	.000	.998
Group	87.65	3	29.21	5.46	.009	.506
Error	85.60	16	5.35			

Computed using alpha = .05

Table 3 calculated the significant main effect of PQ4R learning intervention on learning outcomes before reading, during reading, and after reading across different times (pretest, posttest, and follow-up) in various phases with the numerical values of $F(1, 16) = 29.2, p = 0.009 < .001$, partial eta squared = .86.

Graph 1: Estimated Marginal Means of Measure



Graph 01 shows that participants using the PQ4R learning intervention have significantly improved their learning outcomes. The experimental group participants scored higher in the posttest than the control group. Furthermore, the graph also showed participants' retention pace of learning outcomes using PQ4R learning intervention in the follow-up period.

4 Discussion

Science lessons are a significant challenge for slow-learner students, who are competing with mainstream primary education students. The study was conducted to analyze the effect of PQ4R

learning intervention on learning outcomes and retention of students across the reading phases. The study findings were significant. The findings displayed that the PQ4R learning intervention enhanced the learning outcomes of slow-learner students over time across different reading phases (before, during, and after reading). The findings were in line with the conclusions of the literature review. The PQ4R learning method enhanced students' learning outputs and reading abilities in science subjects (Dzulhikam et al., [2020](#)).

The PQ4R learning strategy enhanced students' mathematical understanding and problem-solving skills (Romiyati et al., 2023). Integrating PQ4R and the Team Quiz model in e-learning improved students' critical thinking skills and engagement in learning (Asy'ari et al., 2023). The PQ4R strategy as a practical teaching method improved high-level thinking skills among fourth-grade students (Al-Qawabeh et al., [2018](#)). The PQ4R strategy is effective and valid in enhancing creative thinking among school students (Sabrini et al., [2022](#)).

A metacognitive reading strategy in hybrid learning can provide students new reading experiences and perspectives (Mafazy, [2022](#)). The PQ4R strategy is efficacious in upgrading the cognitive and affective learning of the scientific sense of female students (Alshaikh, [2022](#)). The PQ4R strategy improves students' comprehension of editorial texts and can help students identify the main ideas and arguments presented in the texts (Fernando et al., [2022](#)). The PQ4R learning method is a productive strategy for better learning outcomes for students in economics (Mamuasi & Samin, [2023](#)). Moreover, the participants in experimental groups who used PQ4R across reading phases scored higher in the post-test than participants in the control group. The calculations were congruent with subsequent studies that showed that the participants using PQ4R achieved more excellent scores in reading skills of science subjects than the control group (Dzulhikam et al., [2020](#)). PQ4R treatment led to more excellent scores in students' reading comprehension and activity levels than before treatment (Terasne & Hafiz, [2023](#)).

The students who used the PQ4R method scored greater in reading comprehension than the conventional method (Fitriani & Suhardi, [2019](#)). The fourth-grade students of the experimental group who used the PQ4R strategy scored higher in achievement tests than the control group (Tahir & Alshuon, 2023). The participants who used the PQ4R strategy scored higher in reading comprehension skills than the control group (Al-Qawabeh & Aljazi, [2018](#)). PQ4R learning strategy significantly affects the retention of learning outcomes over time, proven by the numerical findings that PQ4R maintained the learning outcomes in the follow-up test compared to the control group. The previous study supported these findings that participants in the experimental group have a more excellent retention pace in learning than the control group (Muhibbuddin & Safrida, [2021](#)).

Both the PQ4R and PQ4R-TPS learning approaches can enhance students' comprehension and retention of concepts, drawing from the unique strengths of each strategy (Setiawati & Corebima, 2017). The PQ4R learning strategy significantly enhanced retention levels of reading comprehension, self-efficacy, and metacognitive thinking (Oguz & Arsalan, [2021](#)).

4.1 Limitations and Recommendations

The current study was conducted only by the government, the Institute for Slow Learners Layyah, and the Department of Special Education in Punjab, Pakistan. Future studies can be performed in various primary and secondary schools to enhance the learning strategy's generalizability. Moreover, the PQ4R learning intervention was applied in science; it could be used in other subjects such as Mathematics, English, and Pakistan Studies for better learning outcomes.

4.2 Practical Implications

The study's findings have significant practical implications for educators, schools, and educational policymakers aiming to improve the learning outcomes of slow-learner students. PQ4R learning intervention is a promising avenue for enhancing all students' learning experiences and outcomes,

regardless of their initial learning pace. The study underscored the importance of addressing different reading phases (before, during, and after reading) to maximize learning outcomes. Schools should invest in teacher training and professional development programs to familiarize educators with the PQ4R intervention and its practical implementation. Consistent exposure to the strategy can lead to more sustainable improvements in slow-learner students' learning outcomes.

4.3 Conclusion

The study focused on the effect of the PQ4R learning intervention on slow-learner students' learning outcomes and retention across various reading phases. The study's findings were noteworthy and aligned with the insights drawn from existing literature. PQ4R learning intervention significantly improved the learning outcomes of slow learner students in the science subject across reading phases over time. Moreover, the students who performed PQ4R learning intervention before, during, and after reading scored higher in the posttest and follow-up sessions than those who did not use PQ4R. Notably, the PQ4R intervention has demonstrated its potential to bridge the performance gap between slow learners and mainstream students, ultimately fostering more inclusive and effective educational practices.

4.4 Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest concerning this article's research, authorship, and publication.

4.5 Ethical Approval

Informed consent was obtained from participants, parents, guardians, and school administration.

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