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# Effects of QD2R Numeracy Enhancement Strategy on the Mathematics Performance of Grade 10 Students

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**Abstract:** Learning mathematics requires an effective and strategic teaching approach. This study aimed to assess the mathematics performance of the learners with the implementation of the numeracy enhancement strategy QD2R (Questions, Drills, Repetition, and Recitation) and to propose a strategy implementation plan to elevate their performances. This study employed the use of a quasi-experimental research design, purposive sampling with 70 Grade 10 students of Lian National High School who were distributed equally to control and treatment groups. The pre-test and post-test results were statistically analyzed using independent and paired sample *t*-tests, and a survey questionnaire was examined by getting the mean and standard deviation. The results indicated that better performance was achieved by the students from the treatment group compared to the students from the control group, as revealed by the Mean Percentage Score (MPS) results, mean scores, and *P* values of their pre-test and post-test scores. The learners' perception of the implementation of this strategy was to a great extent, wherein it was perceived to be more helpful in concepts related to understanding the lesson compared to concepts related to developing their attitude and skills. Moreover, the proposed implementation plan of numeracy enhancement strategy QD2R had three expected outcomes: elevated understanding and performance in mathematics lessons; modified strategy to focus on the development of attitude and skills towards mathematics; and refined and well-implemented QD2R strategy in teaching mathematics. Relative to these expected outcomes, appropriate measures, timeframe, and resources of each were comprehensively formulated.

**Keywords:** Questions, Drills, Repetition, Recitation; Numeracy enhancement strategy; Performance; Mathematics

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## 1. Introduction

Mathematics uncovers fundamental information that can justify everything in this world. It is a diverse area of discipline that can integrate with other areas, disciplines, and fields, including surveys, information, science observations, inferences, evidence, reasoning, and even human behavior and social systems [1]. In the educational setting, it has experienced significant growth, evident in its systems and applications. The role of mathematics is portrayed as part of one's life in terms of the present and future, both professionally and socially [2]. A high value

of interest and importance is given to learning and achieving mathematical skills.

Learning mathematics has become an effective way to build mental discipline and enables one to develop an analytical mind, making connections with the world. It benefits an individual by fostering clearer and quicker thoughts, developing critical thinking, and stimulating practicality. For an ordinary person, the value of mathematics centers on a broader level of engagement with complex mathematical concepts. In a higher interpretation, learning mathematics enables one to engage with all surrounding situations. The significance of it is sometimes set aside since people perform daily activities instinctively, not comprehensively knowing that they are actually applying mathematics, hence, it demands a high extent of understanding this discipline [3,4].

With regard to this requirement, knowledge of mathematics can be acquired effectively within the context of a classroom. Research shows that some of the best ways to learn mathematics include enjoying the process, regularly applying the concepts, and obtaining an understanding of numerical connections [5]. There are several opportunities to develop the abilities and skills that can make a person successful in this process. Being proficient in performing mathematical skills will help a person in work and even in daily life. There are four main ways to improve these skills: using workbooks, taking classes, asking for assistance, and practicing [6]. Despite knowing these concepts, there are still existing challenges and problems encountered in learning mathematics.

Mathematical difficulties can be experienced throughout the learning process, attributed to different weaknesses in some areas. Specifically, incomplete knowledge of number facts and inconsistent computations affect the progress of a learner in this area. Moreover, failure to make meaningful connections within and across mathematics concepts, struggle in integrating knowledge, and inadequate understanding of the mathematics context also contribute to the problems faced by students. Additionally, other issues such as difficulty in interpreting and solving problems and being confused with distinguishing and connecting mathematical symbols add to the weaknesses of students [7].

In the Philippines, the Department of Education gives priority to the improvement of numeracy in early learners. It advises and informs the educational system of the country to do this through curriculum, teaching, learning, and assessment research. Despite having these goals, international assessments report that Filipino learners are lagging in terms of mathematics skills. Currently, the mathematical performance of the learners does not meet the necessary level of proficiency and competence expected from them. There are intervening factors that hinder this process, one of which is the low mastery and performance of basic mathematics skills. Various strategies are introduced and are being implemented to address this concern. Despite the various approaches and strategies employed in teaching and learning mathematics, experiencing low performance is unavoidable. This inevitably leads to difficulties in understanding the lessons and achieving success [8,9]. In a local setting, students under the researcher's guidance are presently facing challenges in learning Mathematics 10 lessons.

It is observed that most learners are experiencing difficulties understanding complex problems due to insufficient mathematics skills. Consequently, the researcher felt the need to craft and introduce a strategy specifically designed to alleviate these difficulties and enhance the performance of the students. Aligned with the study conducted, the numeracy enhancement strategy entitled QD2R: Questions, Drills, Repetition, and Recitation proved effective in enhancing the basic mathematics skills of the learners [10]. In particular, this study resulted in a significantly high level of numeracy skills among the learners, and they demonstrated an increased ability to learn and retain concepts and skills related to basic operations on integers when this strategy was implemented. In the current study, this strategy will be used as an intervention or treatment that focuses on improving their performance in this subject.

The researcher envisioned that this study could contribute to the set of concepts on applicable teaching

strategies in mathematics. Specifically, it was introduced to department colleagues for implementation in their respective classes. The researcher aimed to elevate their skills in numeracy and mathematics learning performance. This was expected to be an established teaching strategy innovation that is responsive to the diverse needs of the students. Additionally, this study could serve as a foundation for future research in developing related numeracy enhancement strategies.

### 1.1. Research objectives

This study assessed the learners' performance in mathematics with the implementation of QD2R: Questions, Drills, Repetition, and Recitation, a numeracy enhancement strategy. It also intended to propose a strategy implementation plan to elevate the performance of the Grade 10 learners of Lian National High School for School Year 2023–2024.

Specifically, the current study intended to:

(1) Determine the difference in the learning performance before and after the QD2R implementation.
(2) Assess the learner's perception in the implementation of the QD2R numeracy enhancement strategy.
(3) Propose an implementation plan for a numeracy enhancement strategy to achieve better mathematics performance.

### 1.2. Hypothesis

There is no significant difference in the learning performance before and after the QD2R implementation.

## 2. Literature review

### 2.1. K to 12 Mathematics Curriculum

In 2012, the Philippines implemented the K to 12 Program, which aims to holistically cultivate Filipino learners into globally competent talents. This program introduced three provisions directly related to mathematics education. One of these provisions involved the introduction of a new curriculum in mathematics, aimed at improving skills in thinking critically and solving problems. By providing practical and sustained guidance to support its implementation and address challenges, this curriculum is expected to succeed in improving mathematics education [11]. Given its role as a solid foundation for essential life skills and concepts, learners must understand and appreciate key principles and concepts of mathematics using appropriate innovations to solve problems, communicate, and make decisions in real life [12]. Likewise, this curriculum also requires pedagogical and conceptual refinements, especially in technology integration and alignment [13]. Alongside its implementation and requirements, various reactions, realizations, and problems arose from different stakeholders [14].

A related study attempted to identify problems in the K to 12 Mathematics Curriculum implementation, which were categorized into concerns related to administrative, teacher, and student [15,16]. The highlighted findings include inadequate training, weak teaching strategies, difficulties faced by teachers, insufficient time, and unavailability of instructional materials. More importantly, the main problems are related to the lack of mastery of mathematics ideas and skills, low skills in solving problems, and unresponsive behavior of the students. In terms of students' achievement, most of them were beginners, and part of the learning competencies were least mastered. One recommendation of this study is to align and improve the competencies with mathematics instruction and assessment [17].

The constant advancement of the K to 12 Mathematics Curriculum and the completion of various related programs for intervention and assistance were proposed [18]. This aligns with the study conducted, which

stated that though the early status of its implementation was recognized as high, some students were weak in certain areas of the mathematics curriculum [19]. This revealed that teachers' teaching methods and strategies significantly affected the implementation status of this curriculum in Junior High School. Moreover, in a quasi-experimental design study, differentiated instruction is determined to be an effective way to address learning gaps in this subject. Specifically, it improved their performances in mathematics even if it was conducted in a short period and increased their confidence in problem-solving [20]. Aligned with the use of differentiated activity, a quasi-experimental study introduced an online Process-Oriented Guided Inquiry Learning (POGIL) environment aimed at developing students' critical thinking in mathematics [21]. This innovation encouraged active participation and improved learning. Furthermore, these teaching strategies and innovations were proven to uplift the knowledge and performance of the students in mathematics.

Studies examined above validate the focus of the current study. Through differentiated teaching instructions, the students are expected to demonstrate skills in thinking critically and solving problems. With the arising problems in the existing mathematics curriculum, introducing these instructions is necessary to further improve the learners holistically. Two of the studies mentioned above employed a quasi-experimental design, which is the same as the research method of this current study. Reviewed studies focused more on thinking skills and various activities, while this study centers on performance through implementing a teaching strategy.

## 2.2. Teaching strategies on numeracy enhancement and intervention

Many learners find mathematics to be a challenging subject. Students who struggle and face difficulties in mathematics often benefit from numeracy intervention strategies. Modifying and integrating these strategies to suit their needs substantially helps them build a strong foundation in mathematics. It is proven that even simple strategies, such as repetition, reviews, timed testing, and group work, can be used to improve their skills. In the research examined, an intervention strategy consisting of creating opportunities and encouraging activities designed in a single-subject multiple-baseline probe was effective [22,23]. Intensive intervention is implemented as an individualized approach to teaching with frequent progress monitoring [24]. There must be a practice guide in the execution of these strategies. These include providing procedural instruction, teaching clear and concise mathematics concepts, utilizing a well-chosen mathematical representation, using a number line to facilitate learning, providing deliberate teaching instruction about word problems, and regularly including timely activities to build mathematics fluency [25].

An intervention addressing one or two students' needs for improvement can be made. A self-management intervention may be more effective if it focuses on only one ability, such as numeracy skills [26]. This is shown in a reform intervention that was widely innovated in the system—Gauteng Primary Language and Mathematics Strategy (GPLMS)—designed to improve the learning outcomes of the students. This is proven to have a positive association with the improvements in their performances [27]. There are many considerations in making intervention strategies, such as connecting words and numbers for better understanding, being consistent, presenting the most needed competencies, and using meaningful images and shapes [28].

With knowledge of goals and guidelines in forming numeracy strategies, it should be noted that having an in-depth understanding of these skills is necessary for higher mathematics concepts. Other approaches used for this include quizzes through offline mobile game applications and the continuous use of mathematical drills. In addition to this are tutorials, repeating activities with low scores, giving supplementary materials, and remedial classes [29,30]. The intervention strategy increases the student's performance. A strategy employing mental mathematics and speed tests known as Drill Exercises Towards Students' Increased Responsive Engagement (DESIRE) concluded that this improves their higher mathematics skills [31].

The research examined above implemented and evaluated several strategies to address problems with numeracy skills that lead to low performance in mathematics. Some studies focused on strategies designed to create opportunities and individualized approaches. In doing so, a practice guide is required, which includes instruction, representation, and activities to build mathematics fluency. On the other hand, some studies concentrated on intervention strategies that target not only the numeracy skills but also the improvement of the learning outcomes. In doing so, various approaches and supplementary materials were introduced. Relative to the conduct of this research, these studies proved that various strategies can be used to achieve multiple objectives. Thus, this research aims to implement a combination of strategies that may improve students' mathematical performances.

## 2.3. Better performance in Mathematics

With the numeracy intervention and enhancement strategies discussed in the previous theme, there is an enhancement in the performance of the learners [32]. Thus, numeracy skills predict their achievement and success, indicating the need for a strong foundation in these skills [33,34]. The counterpart of this concept denotes that having these skills at an early stage is crucial for future academic success [35]. The acquisition needs to happen at a young age since this is the best time to begin learning mathematics. Students at the secondary level may be at risk of low performance in this subject and therefore need more opportunities to learn these skills [36].

The general understanding of the connection between numbers, words, symbols, and concepts in mathematics is important in numeracy [37,38]. This means that if they do not know how to interpret and connect, they will find it difficult to perform mathematics activities and even solve problems. Students need to understand the tasks they are doing to be successful in this matter. Likewise, having no interactions and integration on numeracy may lead to not performing the skills correctly. Moreover, without this strong foundation, learners will struggle to continue learning more advanced knowledge and skills [38-40].

Moreover, having skills in numeracy is connected to skills in solving problems, thinking logically, and reasoning. The skills of understanding numbers, basic operations, and learning more complex problems are needed. In the process of achieving these skills, educators can integrate fun activities involving numbers, shapes, patterns, etc., into mathematics concepts. The activities must not be limited to paper and pencil tasks. Proven to be effective, numeracy knowledge and skills must be strengthened since they are essential for success in mathematics, enhancing abilities in problem-solving, improving mental agility and focus, boosting self-esteem, and encouraging exploration and creativity [40,41]. Accomplishing these, the students can reach an advanced level of numeracy skills and an outstanding level of performance in mathematics [42].

The related literature discussed above proved and validated that mathematics performance can be elevated through improving numeracy skills, which are also highlighted by some research. The students must have a strong foundation of numeracy skills, which can predict their achievement and success; thus, these should be obtained at an early stage. If not achieved at this stage, students at the secondary level may demonstrate low performance in mathematics. On the other hand, some studies mentioned that having numeracy interactions leads to not performing the skills and may struggle to learn the advanced skills. Obtaining these necessary skills can lead to an outstanding level of mathematical performance. Relative to the current study, students who were not able to master these skills at an early age are expected to do so during their secondary education. The QD2R teaching strategy is presumed to prove that strengthening numeracy skills indicates a higher level of performance in mathematics.

Mathematics is challenging for both students and teachers, especially when it comes to problem-solving. This is addressed by introducing various mathematics teaching strategies from simple, like repetition, to

complex, such as applying metacognitive skills and conceptual teaching. Problems encountered in numeracy skills may affect the performance of the students. There are various enhancement and intensive intervention strategies discussed herein. Improving numeracy skills can elevate their mathematics performance. These procedures can result in the capability to solve problems, improve mental agility, and develop self-esteem.

Generally, the related literature examined in the previous part substantiates the major concern of the current study. Through a quasi-experimental research method, which is the same as the previous studies, the objectives of this study will be answered. The studies above focused more on thinking skills and various activities while this study centers on the mathematical performance of the students through implementing a teaching strategy. The problems encountered in numeracy skills are the major concerns of this study, as discussed above. In addressing these concerns, unlike the previous studies wherein only one strategy was used as the intervention or instruction, the current study aims to implement a combination of strategies in mathematics, which is called the QD2R.

# 3. Research methods

## 3.1. Research design

This study employed the use of quantitative research design, in particular, quasi-experimental design, which tested causal hypotheses. The design lacked random assignment of participants to conditions, even though the independent variable was manipulated. The study identified a control group and a treatment group with similarities in terms of baseline characteristics [43,44].

In this study, the researcher selected the respondents non-randomly. Two groups were formed, and the performance of the students relative to their numeracy skills was assessed with the implementation of QD2R: Questions, Drills, Repetition, and Recitation, a numeracy enhancement strategy.

## 3.2. Respondents and sampling

In a quasi-experimental research design, a non-random method of assignment was used. Thus, the sampling was purposive. The target population was non-randomly assigned to the control and treatment groups. This implies that there may be systematic differences between these groups. A quasi-experimental design is appropriate when there is a sufficiently large target population [45]. Subjects or participants were appointed to groups based on non-random criteria [46].

In this study, the researcher selected 35 Grade 10 students for each group. The control group was Grade 10 section Aristotle, and the treatment group was Grade 10 section Kepler. They were not randomly selected; instead, Grade 10 sections were assigned to the two groups. These participants were the students of Lian National High School who were enrolled during the School Year 2023–2024. **Table 1** shows the information and distribution of respondents.

**Table 1.** Distribution of respondents

| Respondents' information | Control group | Treatment group |
|---|---|---|
| Grade and section | G10-Aristotle | G10-Kepler |
| Male | 14 | 17 |
| Female | 21 | 18 |
| Total | 35 | 35 |

## 3.3. Instrument

In this quasi-experimental design, the researcher used two main tools for the collection of data. Firstly, the pre-test and post-test questions were given before and after the implementation of the numeracy enhancement strategy. This determined the difference in the performance of the learners relative to QD2R. Secondly, a survey questionnaire was administered to assess their perception of its implementation. Four validators with expertise in grammar and construction subjected these two instruments to language validation. The test questions were validated as excellent with a mean score of 4.88, while the survey questionnaire was also excellent having a mean of 4.98. On the other hand, the pre-test and post-test questions underwent content validation by four validators with expertise in mathematics teaching. These instruments were validated to be excellent with a mean score of 4.55. Thus, the test questions and survey questionnaire were expected to derive accurate data that explained and answered the objectives of this study.

## 3.4. Data collection

Upon securing permission to conduct this study, the researcher eventually proceeded to the collection of data. There were systematic procedures followed for the attainment of the objectives of this study. This quasi-experimental study was done in various ways.

The first step was to determine the baseline data through the administration of pre-test questions. This determined the Mean Percentage Score (MPS) results and mean scores, which served as the focus of this enhancement strategy. There was always a five-minute implementation of this QD2R before the class began, including items related to the current topic. Plus, the other components of this strategy were executed during the lesson discussion.

Then, the treatment was eventually implemented in the treatment group through a series of questions, drills, repetition, and recitation (QD2R). The scores of students from these two groups were analyzed and compared. The last step was the administration of the post-test questions and survey questionnaire. Then, the accomplishment of the write-ups followed. These steps were expected to provide comprehensive results for the success of this study.

## 3.5. Data analysis

After gathering data following the procedures above, it was analyzed and underwent statistical treatment. In the first objective, the difference in the learning performance before and after the QD2R implementation was determined. The scores in the pre-test and post-test of both the control and treatment groups were recorded. Then, the researcher ran a test of normality distribution. Assuming that the data was normally distributed, it was analyzed using independent and paired sample *t*-tests.

For the second objective, their perception of the implementation of the numeracy enhancement strategy was assessed. This was done through the responses to the survey questionnaire. Mean and standard deviation (SD) were used. The scale and mean range with appropriate interpretation are shown in **Table 2**.

**Table 2.** Mean range and its interpretation

| Scale | Mean range | Interpretation |
|---|---|---|
| 4 | 3.26–4.00 | Great extent |
| 3 | 2.51–3.25 | Moderate extent |
| 2 | 1.76–2.50 | Low extent |
| 1 | 1.00–1.75 | Not at all |

The last objective was to propose a numeracy enhancement strategy implementation plan to achieve better performance in mathematics. The plan was based on the pre-test and post-test results, as well as the assessment of their perception of the implementation of QD2R.

### 3.6. Ethical considerations

This study followed different ethical considerations. As a researcher, these sets of principles were always considered when collecting data from humans, especially from students in this study. Upon the completion of the research proposal, the researcher requested authorization from the principal of Lian National High School. Then, the student respondents were informed about the study, and they were asked to affix their signature on the consent, along with their parents.

The ethical considerations employed in this study were as follows. There was voluntary participation from Grade 10 students. Their identification was hidden through anonymity. The responses of the students remained confidential and were only used for the purpose of this study. The researcher refrained from any form of plagiarism. Lastly, the students were notified about the results of this study.

## 4. Results and discussion

### 4.1. Comparison of the performance of the learners before and after the QD2R implementation

Evaluating the performance of learners in mathematics is a crucial aspect of determining the appropriateness and effectiveness of a teaching strategy. In the context of this study, the performances of students in the control and treatment groups before and after the intervention were identified through pre-test and post-test scores. The assessment utilized MPS, frequency, and the percentage of test results. **Table 3** below presents the MPS of the pre-test and post-test scores for the control and treatment groups.

**Table 3.** MPS of the pre-test and post-test scores

| Group | Pre-test | | | | Post-test | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | MPS | Interpretation | Mean | SD | MPS | Interpretation |
| Control group | 13.71 | 2.44 | 34.29 | Low mastery | 24.14 | 4.37 | 60.36 | Moving towards mastery |
| Treatment group | 12.29 | 2.86 | 30.71 | Low mastery | 28.26 | 6.52 | 70.64 | Moving towards mastery |

Source: DepEd Level of Mastery

In the pre-test, both groups exhibited low mastery of the competencies with an MPS of 34.29 and 30.71, respectively. Notably, the control group achieved 3.58 more than the treatment group. Moving to the post-test, both groups reached the level of moving to mastery with an MPS of 60.36 and 70.64, respectively. Interestingly, the treatment group outperformed the control group by 10.28. Both groups demonstrated low mastery in the pre-test, reflecting the absence of substantial learning, and the difference in their MPS results was minimal. Similarly, their post-test results only advanced one level than their pre-test scores, given the limited two-week implementation period of QD2R.

Analyzing the results of the pre-test, the control group had 21 students above the mean score of 13.71, two students within this mean, and 12 students below this mean. In contrast, the treatment group had 17 students above the mean score of 12.29, four students within this mean, and 14 students below this mean. Shifting to their post-test, the control group showed 17 students above the mean score of 24.14, with no students within

this mean, and 18 students below this mean. Meanwhile, in the treatment group, 18 students scored above the mean score of 28.26, one student within this mean, and 16 students below this mean.

Educators can conduct a comparative analysis of MPS results to derive meaning and interpretation from the data [47]. Such analyses aid in making decisions on enhancing lesson delivery and utilizing learning resources. In the current study, the presented results indicate a relevant increase in the performances of both groups, as evidenced by the MPS and mean scores of the post-test. Notably, the control group obtained a higher MPS in the pre-test, while in the post-test, the treatment group achieved a higher MPS. It is important to note that this relevant increase may not be identified as significant, given the relatively minor variation in their scores.

**Table 4** presents the pre-test results of the control and treatment groups, categorized into five score points. In the control group, 33 students, accounting for 94.3%, scored in the range of 11–20, which is below average. Additionally, two students, constituting 5.7% of the control group, scored in the poor level category. In the treatment group, 25 students, or 71.4%, received scores in the 11–20 range, while ten students, or 28.6%, scored in the poor level category.

**Table 4.** Pre-test results

| Score points | Control group | | | Treatment group | | |
|---|---|---|---|---|---|---|
| | Frequency | Percentage | Description | Frequency | Percentage | Description |
| 36–40 | 0 | 0.0% | Excellent | 0 | 0.0% | Excellent |
| 31–35 | 0 | 0.0% | Good | 0 | 0.0% | Good |
| 21–30 | 0 | 0.0% | Average | 0 | 0.0% | Average |
| 11–20 | 33 | 94.3% | Below average | 25 | 71.4% | Below average |
| 0–10 | 2 | 5.7% | Poor | 10 | 28.6% | Poor |
| Total | 35 | 100.0% | | 35 | 100.0% | |
| Average score | 13.7 | | | 12.3 | | |
| Description | Below average performance | | | Below average performance | | |

The average score of the control group is 13.7, which is 1.4 more than the treatment group's score of 12.3. Both average scores are below the average performance level before the implementation of QD2R. In the pre-test results of the control group, 21 students scored above the mean score of 13.71, two students scored within this mean, and 12 students scored below this mean. In the treatment group, 17 students scored above the mean score of 12.29, four students scored within this mean, and 14 students scored below this mean.

**Table 5** shows the post-test results of the control and treatment groups, categorized into five score points. In the control group, 26 or 74.3% of the control group while 18 or 51.4% of the treatment group obtained a score of 21–30 in the average level. There were six or 17.2% of the treatment group while none of the control group obtained scores of 36–40, which was interpreted as excellent.

The average score of the treatment group is 28.3, which is 4.2 higher than the score of 28.3 in the control group. Both average scores are at the average performance level. The table shows that there were 17 students who scored above the mean score of 24.14, no students were within this mean, and 18 students were below this mean in the control group. Moreover, there were 18 students who scored above the mean score of 28.26, one student within this mean, and 16 students were below this mean in the treatment group.

**Table 5.** Post-test results

| Score points | Control group | | | Treatment group | | |
|---|---|---|---|---|---|---|
| | Frequency | Percentage | Description | Frequency | Percentage | Description |
| 36–40 | 0 | 0.0% | Excellent | 6 | 17.2% | Excellent |
| 31–35 | 3 | 8.6% | Good | 7 | 20.0% | Good |
| 21–30 | 26 | 74.3% | Average | 18 | 51.4% | Average |
| 11–20 | 6 | 17.1% | Below average | 4 | 11.4% | Below average |
| 0–10 | 0 | 0.0% | Poor | 0 | 0.0% | Poor |
| Total | 35 | 100.0% | | 35 | 100.0% | |
| Average score | | 24.1 | | | 28.3 | |
| Description | | Average performance | | | Average performance | |

**Table 6** shows the difference in the pre-test and post-test scores of the two groups. In the control group, the resulting *P* value of 0.000 indicates that there is a significant difference in their scores. Similarly, the *P* value of 0.000 means that the difference in the scores of the treatment group is also significant.

The two groups revealed the same resulting *P* values and decisions, which implies that the post-test scores of students differ from their pre-test scores. This does not necessarily mean that the use of the QD2R strategy in the treatment group is effective. Similarly, the difference in the learner's performance before and after its implementation cannot be yet determined. Thus, there is a need to determine whether the difference between the pre-test scores of both groups as well as their post-test scores is significant.

**Table 6.** Difference in the pre-test and post-test scores of the groups

| Variables | Computed value | *P* value* | Decision on $H_0$ | Interpretation |
|---|---|---|---|---|
| Control group | -16.910 | 0.000 | Reject | Significant |
| Treatment group | -15.418 | 0.000 | Reject | Significant |

*significant at $P < 0.05$

**Table 7** identifies the difference in the pre-test scores and post-test scores of the control and treatment groups. The *P* value of 0.028 means that there is a significant difference in the pre-test scores of the control and treatment groups. Likewise, the *P* value of 0.003 indicates that the difference in their post-test scores is highly significant. The difference in the results of their post-test is more significant than the difference in their pre-test scores as revealed by the *P* values.

These values can be connected to the resulting means in **Table 5**. The difference is highly significant in their post-test scores wherein the treatment group has an average score of 28.3, which is 4.2 higher than the control group's average score. This denotes that the students in the treatment group performed better than those students in the control group. Thus, there is a significant difference in the learner's performance before and after the implementation of QD2R, and the QD2R strategy is effective.

**Table 7.** Difference in the pre-test and post-test scores

| Variables | Computed value | *P* value* | Decision on $H_0$ | Interpretation |
|---|---|---|---|---|
| Pre-test scores | 2.249 | 0.028 | Reject | Significant |
| Post-test scores | -3.099 | 0.003 | Reject | Significant |

*significant at $P < 0.05$

## 4.2. Perception of the learners of the implementation of the numeracy enhancement strategy

As important as the test scores of students in determining their performance in mathematics relative to the implementation of QD2R, their perception of this numeracy enhancement strategy is also assessed. The assessment is done through a ten-item survey questionnaire wherein the mean of their responses and the verbal interpretation were determined.

**Table 8** summarizes the learners' perception of the implementation of QD2R as revealed by mean scores. The overall mean of 3.63 implies that their perception of the indicators is to a great extent. Their perception that this strategy is helpful in understanding more about the lessons has the highest mean of 3.91. The students perceived that this strategy is helpful in learning more complex concepts and provides opportunities to show their skills in mathematics have mean scores of 3.77 and 3.71, respectively.

On the other hand, their perception that this strategy presents different sets of engaging activities had the lowest mean of 3.34, which is at great extent. The results above imply that the QD2R numeracy enhancement strategy is perceived to be more helpful when it comes to understanding lesson-related concepts compared to developing their attitude and skills related to concepts.

**Table 8.** Perception of the learners

| Indicators | Mean | SD | Verbal interpretation |
|---|---|---|---|
| The numeracy enhancement strategy | | | |
| 1. helps me to understand more about the lessons. | 3.91 | 0.28 | Great extent |
| 2. helps me to learn the more complex concepts. | 3.77 | 0.43 | Great extent |
| 3. provides opportunities to show my skills in mathematics. | 3.71 | 0.46 | Great extent |
| 4. introduces tasks relevant to our current lesson. | 3.66 | 0.48 | Great extent |
| 5. encourages me to be an active learner. | 3.66 | 0.48 | Great extent |
| 6. develops my prior knowledge and skills on basic mathematics. | 3.63 | 0.49 | Great extent |
| 7. improves my ability to learn and perform the tasks better in mathematics. | 3.60 | 0.50 | Great extent |
| 8. develops my confidence in mathematics. | 3.57 | 0.50 | Great extent |
| 9. makes the activities easier to accomplish. | 3.49 | 0.51 | Great extent |
| 10. presents a different set of engaging activities. | 3.34 | 0.48 | Great extent |
| Overall mean | 3.63 | | Great extent |

## 4.3. Proposed implementation plan for numeracy enhancement strategy to achieve a better performance in mathematics

The findings of this study reveal that the treatment group has an average post-test score of 28.3, which is 4.2 higher than the average post-test score of the control group. Additionally, the difference in the post-test scores

of the control group and treatment group is significant. Thus, there is a notable difference in the learner's performance before and after the QD2R implementation. These results lead to the formulation of the proposed numeracy enhancement strategy implementation plan as presented in **Table 9** to achieve better performance in mathematics.

**Table 9.** Proposed numeracy enhancement strategy implementation plan of QD2R

| How | Actions | Measures | When will this be achieved | Resources |
|---|---|---|---|---|
| Outcome **1**: Elevated understanding and performance in mathematics lessons | | | | |
| Strengthening the involvement of students in the process | To encourage and address the students' needs and interests | Percentage of increase of involved students | End of every quarter | Within current resources |
| Focusing on least mastered skills in mathematics | To administer diagnostic/pre-assessment | Identified least mastered skills | Beginning of school year | Within current resources |
| Integrating the use of QD2R in teaching | To introduce the QD2R through various activities and intervention with consistent application | Quarterly assessment and grades | End of every quarter | Within current resources |
| | To administer pre- and post-assessments | Analysis of test scores | Pre-test: Q1<br>Post-test: Q4 | Within current resources |
| Outcome **2**: Modified strategy that also focuses on attitude and skills towards mathematics | | | | |
| Encouraging involvement on accomplishing activities | To introduce various activities that can boost their attitude towards the subject | Performance task results | End of class | Within current resources |
| Providing opportunities to showcase one's skills | To make lesson plans with learning opportunities that cater learning styles | Evaluation and documentation of daily learning outcomes | End of class | Within current resources |
| Outcome **3**: Refined and well-implemented QD2R strategy in teaching mathematics | | | | |
| Improving and developing the components of QD2R | To design questions and activities to be used for this strategy | Set of well-designed questions and activities | Evaluation on fourth quarter | Within current resources |
| | To regular monitoring, evaluation, and modification of this strategy | Percentage of increase of learning outcomes | Evaluation will be done after daily implementation | Within current resources |
| Strengthening the implementation of QD2R strategy | To inform students about the existing QD2R strategy by applying it | Awareness of students | First quarter | Within current resources |
| | Consistent application and integration of QD2R strategy in lesson discussion | Evaluation and documentation of daily learning outcomes | Evaluation on fourth quarter | Within current resources |
| | To share the strategy to colleagues | Use of QD2R strategy across grade levels | First quarter | Within current resources |

The table above presents the proposed numeracy enhancement strategy implementation plan of QD2R. As highlighted, there are three expected outcomes from this strategy: elevated understanding and performance in mathematics lessons; a modified strategy that also focuses on attitude and skills towards mathematics; and a refined and well-implemented QD2R strategy in teaching mathematics.

Outcome 1 focuses on students' learning and performance in mathematics. This can be achieved through strengthening student involvement in the process, focusing on the least mastered skills, and integrating the use of QD2R in teaching. Outcome 2 targets the development of their attitude and skills, as their related concepts had the lowest means in the perception of the learners. This can be done through encouraging involvement in accomplishing activities and providing opportunities to showcase one's skills. Lastly, Outcome 3 centers on the QD2R strategy itself. This can be accomplished by improving and developing the components of QD2R and strengthening the implementation of the QD2R strategy. Relative to these expected outcomes, the measures, timeframe, and resources for each are comprehensively formulated.

# 5. Conclusions and recommendations

## 5.1. Conclusions

The conclusions derived from the results and discussion are as follows:

(1) The performances of both groups showed a relevant increase, as indicated by MPS results and mean scores of pre-test and post-test. In the pre-test, the average score of the control group was higher than the treatment group, and both were below the average performance level. In contrast, the average post-test score of the treatment group was higher than the control group, and both were at the average performance level. The difference in their pre-test and post-test scores was significant, signifying a notable improvement in the learners' performance after the implementation of QD2R. Consequently, the students of the treatment group outperformed those in the control group, indicating the effectiveness of the QD2R strategy.

(2) Learners perceived the implementation of the QD2R strategy to a great extent, as indicated by an overall mean. The results suggest that the QD2R numeracy enhancement strategy is perceived as more helpful in understanding lesson-related concepts compared to developing their attitudes and skills related to concepts.

(3) The proposed numeracy enhancement strategy implementation plan for QD2R outlined three expected outcomes: elevated understanding and performance in mathematics lessons; a modified strategy focusing on attitude and skills towards mathematics; and a refined and well-implemented QD2R strategy in teaching mathematics. The actions, measures, timeframes, and resources for each outcome are comprehensively formulated relative to the expected results.

## 5.2. Recommendations

From these conclusions, the recommendations are hereby enumerated:

(1) The proposed numeracy enhancement strategy implementation plan for QD2R, with its three expected outcomes, can be reviewed and applied in teaching mathematics across various grade levels.

(2) When designing and implementing a numeracy enhancement strategy, it is necessary to consider addressing the development of students' attitudes and skills.

(3) Future researchers can utilize this study as a reference and a source of new ideas regarding the implementation of QD2R-related teaching strategies in mathematics, with a focus on students' performance, involving a larger and diverse group of respondents.

# Disclosure statement

The author declares no conflict of interest.

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