

Integrating Reading Strategies into Grade 7 Mathematics: An Investigation of Performance Outcomes

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Abstract: *This study explores the effectiveness of integrating reading and comprehension strategies into Grade 7 mathematics lessons to improve student performance. Utilizing a quasi-experimental design with a purposive sample of 58 secondary school students in Jamaica, the study employed diagnostic reading tools and mathematics assessments to gather pre- and post-intervention data. The results showed that 87% of students read below grade level and exhibited low mathematics proficiency. Statistical analysis indicated no significant improvement in performance following the intervention. While short-term results were inconclusive, the findings underscore the potential value of embedding literacy strategies in math instruction and highlight the need for long-term, targeted interventions to address systemic literacy and numeracy challenges.*

Keywords: mathematics education, reading strategies, comprehension skills, grade 7 learners, academic performance

1. Introduction

The secondary level of the Jamaican education system is a crucial stage in the academic journey of students in Jamaica. This level spans a duration of 5 years (Grades 7 to 11) with an optional extension of 2 years (Grades 12 to 13) for students who wish to proceed to the Advanced level. According to Singh (2024), Grade 7 is an important step in the life of a student. At this level, the curriculum becomes more comprehensive and career-oriented, with increased emphasis on Science, Technology, Engineering, and Mathematics (STEM) subjects when compared to the primary level. In addition, this grade level is known as a stage of discovery and exploration in the experience of the students at the secondary school level. Thus, this study focused specifically on Grade 7 level. Patterson (2022) reported that of the students who entered Grade 7 in 2022, only forty-one percent (41%) passed their mathematics examination in the Primary Exit Profile (PEP). In Jamaica, this is considered an underachievement of Grade 7 students in mathematics, and if this is not addressed at this particular grade level, it will constitute more problems for the students in the mastery of mathematics at higher Grade levels. Patterson (2022) also expressed that 56% of the students who entered Grade 7 in 2022 could not write; one-third of the students were unable to read, and 57% were unable to identify information in a simple sentence. Therefore, a possible solution to improve students' performance in mathematics would be to incorporate reading and comprehension strategies in mathematics lessons. Reading and comprehension strategies involve extracting and constructing meaning through interactions and involvement with written language (Woolley, 2011). This plays a key role in students' performance in mathematics as it is closely related to students' ability to grasp mathematical concepts and also their problem-solving abilities (Akin, 2022; Samuels, 2023). The incorporating of reading and comprehension strategies in the mathematics classroom at

the Grade 7 level in Jamaica serves as motivation for conducting this research.

At the secondary school level, mathematics remains a challenge for Jamaican students. This is supported by Caribbean Examination Council (2022) which reported that in 2021 and 2022, the pass rate in Mathematics at the Caribbean Secondary Education Certificate (CSEC) Examination were thirty-seven percent (37%) and forty-one percent (41%) respectively. Smith (2023) also noted that the pass rate in Mathematics for the 2023 CSEC Examination was 44.7%. According to the Ministry of Education and Youth (2021), forty-eight percent (48%) of students who entered grade 7 in 2021 were proficient or highly proficient in mathematics. Furthermore, fifty eight percent (50.8%) of Grade 7 students were at or above proficiency in mathematics in 2022 (Ministry of Education and Youth, 2022). Therefore, a study focused on Grade 7 students is necessary to help improve their performance as they progress through secondary education.

Purpose of the Study

This study sought to identify the key reasons for Grade 7 students' poor performance in mathematics. In the process of exploration, the teacher researcher sought to explore the effectiveness of integrating reading and comprehension strategies in her mathematics lessons to determine the levels of improvement of their performance in mathematics.

Significance of Study

This study is significant as it examines a targeted pedagogical intervention aimed at improving mathematical understanding among underperforming Grade 7 students through literacy strategies. Its findings may inform teacher training, curriculum design, and broader education policy within Jamaica and similar contexts.

Research Questions

1. What is the percentage of students in the selected sample that have challenges reading and also poor in Grade 7 mathematics?
2. What is the performance of students in Grade 7 mathematics before and after the exposure to reading and comprehension skills?
3. Is there any relationship between the performance of students in Grade 7 mathematics and the exposure to reading and comprehension skills?

Research Hypotheses

Null Hypothesis (H_0): There is no significant difference between the performance of students who are exposed to reading and comprehension skills and students' performance in Grade 7 mathematics

Alternate Hypothesis (H_1): There is a significant difference between the performance of students who are exposed to reading and comprehension skills and students' performance in Grade 7 mathematics.

Definition of Terms

Reading – Reading refers to the ability to interpret written symbols and understand printed materials (Johnson, 2017).

Reading in Mathematics – The use of texts or written words in mathematics lessons (Purpura et al., 2019). The study made use of two components of reading (vocabulary, and Reading comprehension) in mathematics lessons. This took the form of oral reading in the mathematics lessons, whereby the stated strategies were used to guide students towards extracting pertinent information from each work of writing they read. Thus, students read text materials, written instructions, and different worded scenarios in the mathematics lessons and were guided towards deriving meaning from the text.

Grade Level Reading – The average difficulty of a passage (determined by particular formulas) that the majority of students at a particular grade level are expected to be able to read with understanding (Carver, 1975). The standards for this are outlined by the Ministry of Education in Jamaica in the standard Informal Diagnostic Reading Inventory test that is used in assigning students to the various pathway levels.

Disciplinary Literacy – Disciplinary Literacy refers to a specialized way of reading, understanding, and thinking used in a particular academic discipline, such as mathematics or science (Shanahan & Shanahan, 2012). Aspects of this study included disciplinary literacy; however, this was not the main focus as the researcher sought to focus on the students learning different terms (does not have to be math-related) in an effort to enhance their vocabulary and also using reading comprehension strategies in order to enhance their ability to understand what they read.

Vocabulary – According to Johnson (2017), Vocabulary refers to all the words an individual knows. This entailed

student learning new terms (both mathematical and non-mathematical terms) and their meanings throughout the mathematics lessons. For example, students discovered that “Shared” in mathematics is linked to division or ‘repeated subtraction’. These terms were incorporated into written instructions or tasks to allow students to build their vocabulary. A variety of text materials were also used to achieve this.

Reading Comprehension – According to Johnson (2017), reading comprehension involves deducing meanings from texts. The study utilized the post-reading instructions which entail reading, asking questions, summarizing, and retelling. For example, a task is given and students are required to read the given task. Afterward, they were asked to summarize and tell what was read, what is being asked of them, and how it is possible. They were allowed to read multiple times in an effort to make sense of what was read.

Oral Reading – This refers to the verbal translation of printed or written material which is usually used to assess students' comprehensive reading abilities which may examine various elements such as fluency, reading accuracy, and comprehension- which all may not be readily apparent during silent reading (Stefanko, 2011). The researcher provided an opportunity for students to practice oral reading by reading from the board and also text materials. They also did peer reading where students were paired to allow them to help each other while practicing oral reading in the mathematics lessons.

Mathematics Performance – Mathematical Achievement is the competency shown by the student in the subject of mathematics (Pandey, 2017). For this study, the student's performance was measured by their particular performance on the pretest and posttest assessment tools.

2. Literature Review

This section explores studies that are focused on reading in Mathematics and thus include: a theoretical framework; reading and its importance; reading levels and skills for grade 7 students and challenges; achieving reading level at the grade 7 level; reading in mathematics; and finally, vocabulary and reading comprehension in mathematics.

Vygotsky's Zone of Proximal Development

Learning is a social process and as a result, it is imperative that a classroom represents a social space (Vygotsky, 1978). According to Brinker (2013), the best classroom environment that suits learners who struggle with reading is one in which they are comfortable working together and sharing ideas with peers and teachers without being discriminated against. To ensure this, Vygotsky (1978) built his theory on two metaphors: Zone of Proximal Development and Scaffolding (McLeod, 2008). The Zone of Proximal Development refers to the gap between an individual's current and potential development if additional support is provided. This additional assistance rendered to these students is called scaffolding (McLeod, 2023).

Incorporating reading in mathematics lessons may facilitate the basics of the social learning theory as the teacher provides additional reading assistance to students through different strategies, for example using comprehension strategies and vocabulary building (Suheri, 2018). According to Vygotsky (1978) theory, scaffolding does not last forever and occurs until the individual is able to grasp and apply concepts on their own. Thus, it is vital for a teacher to provide the necessary support that will guide students toward achieving independence in the learning environment. Once this is the reality, Vygotsky (1978) explained that support may be gradually removed so that students may begin to rely less on the more knowledgeable others, and more on their own reasoning and understanding. In this regard, Poorahmadi (2009) stated that scaffolding focuses on developing students' conceptual understanding as they are able to interpret information as they explore and solve problems- rather than relying on memorized steps. Thus, providing students with additional reading support may not only improve their interest in the subject area but also allow them to be better critical thinkers as they work towards solving new problems in the mathematics classroom.

Emergent Literacy Theory

Another theory that underpins this study is the Emergent Literacy theory. According to Rohde (2015), Emergent Literacy refers to the reading and writing experience of young children before they are traditionally taught to read and write. Emergent Literacy is one of the most important aspects of the life of a child and this begins in the home. Similarly, studies have shown that a child's growth in his or her ability to read and write is greatly related to stimulation from the child's environment (Rhode, 2015). Thus, a positive environment may improve a child's literacy development, which may reflect positively on their future academic performance (Erickson & Koppenhaver, 2016).

Results from high-stakes mandatory testing across the various grade levels (which is done nationwide) showed that most students are reading below their expected grade level (Joseph, 2023). This may have been caused by many different factors, including a negative home environment. The theory of emergent literacy was posited by Marie Clay in 1991 and recognizes a close relationship between the instructional scaffolds used by educators to promote young children's emerging reading, writing, and oral language skills. Like Vygotsky (1978) theory of social learning, Clay stressed the need for teachers to know the student's zone of proximal development so that the learning space may be used to enhance a child's literacy development. According to Erickson & Koppenhaver (2016), "Literacy is learned through interaction with and exposure to all aspects of literacy (i.e. listening, speaking, reading, and writing)". Thus, the incorporation of reading in the mathematics classroom may expose students to all aspects of literacy as they learn to read, communicate with peers and teachers, listen to instructions, and also write worded questions and notes.

2.1 Reading and Its Importance

Johnson (2017) defines Reading as the ability to interpret written symbols and understand printed materials. Grell (2023) refers to reading as an active process that includes the decoding of symbols in text materials in order to arrive at particular meanings. There are four stages in reading Grell (2023) and these are:

- Pre- Reading: Students begin to develop a purpose for reading as they get familiar with letters and their fundamentals.
- Phonemics: Students begin to understand that letters have sounds and putting sounds together will formulate words.
- Sight Word Recognition: Only possible with a strong Phonemic background as these sight words are words that may not abide by the usual phonemic rule and so the reader should be able to identify these.
- Fluency: At this stage, students are able to apply the knowledge from the previous stages in order to effectively read and interpret more complex texts materials.

Reading plays a major role in the teaching and learning process. According to Villanueva (2022), reading is a determining factor of the efficacy of students of how efficient students are throughout school, university, or college. While Clarke and Rumbold (2006) believe that the ability to read is an essential tool for an individual's long-term success, Jose and Raja (2011) believe that reading allows for critical thinking- an important skill needed for 21st-century learners and professionals. Jose and Raja (2011) further explained the need for students to be able to learn from reading in order to enter a literate society. According to the International Reading Association (Moore et al., 1999, p. 3):

Adolescents entering the adult world in the 21st century will read and write more than at any other time in human history. They will need advanced levels of literacy to perform their jobs, run their households, act as citizens, and conduct their personal lives. They will need literacy to cope with the flood of information they will find everywhere they turn. They will need literacy to feed their imaginations so they can create the world of the future. In a complex and sometimes even dangerous world, their ability to read can be crucial. Thus, the development of individuals' reading skills and abilities is of great importance, especially in today's society.

2.2 Reading Skills Challenges Facing Grade 7 Students

A term that is closely affiliated with reading level is "Grade Level Reading". Blankly (2022) refers to this as the average difficulty of a passage (determined by particular formulas) that the majority of students at a particular grade level are expected to be able to read with understanding. Wepner et al., (2013) believed that learning to read is a multifaceted process in which students may learn to do so at different stages of their lives- with or without additional assistance. Similarly, Durden (2015) stated that students' reading levels and comprehension skills may develop at different rates. It could therefore be deduced that students' progress through the different stages of reading at different paces, which may

result in a need for external support, or scaffolding, to ensure the successful mastery of skills.

Based on students' grade level, there are particular reading skills that students are expected to portray. At the Grade seven-level, students are expected to be able to read text materials to determine facts and draw conclusions (Pellissier, 2022). Likewise, an article published by Scholastic Parent Staff (2020) highlighted that students at Grade 7 level should be able to "examine texts more closely and use details from the text in order to develop ideas, analyze, and make inferences." One example of this is through students' reading a worded mathematical question and interpreting what is given in order to determine possible routes of solution(s).

In regards to the above-stated, students' ability to achieve the reading skills necessary at the required grade level is usually hindered by many factors. A study by Vertucio (2018), found that at the Grade 7 level, "fluency, vocabulary, background knowledge, comprehension strategies, and lack of self-motivation were some of the factors affecting the performance of the respondents in reading". In addition to this, Espiel and Carretero (2022) revealed a lack of reading materials negatively reflects on students' reading and comprehension skills since, at this level, a great need exists for a student to be given reading materials that will provide motivation, thus increasing their interest in developing their skills in their area of literacy. In some studies, the lack of parental involvement may significantly impact the development of students' reading abilities. Stutzel (2019) and McMahon (2010) unveiled a positive correlation between parental involvement and students' early development of literacy skills (including reading) development. Furthermore, Jose and Raja (2011), stated that reading in the early stages of students' life is important and must be taken seriously by teachers (including parents) to ensure that students are not flustered and get full clarifications when needed since once their love for reading had disappeared, their ability to excel in the skill becomes even difficult in later years.

2.3 Improving Reading Skills for Grade 7 Students

Reading is a language-based skill that must be taught explicitly, and for many children, specific decoding, word recognition, and reading comprehension skills must be taught directly and systematically (Espiel & Carretero, 2022). At the Grade 7 level, there are multiple suggestions made for teachers to provide the necessary scaffolding needed for students to be able to read and comprehend at the grade seven level and above. Espiel and Carretero (2022) suggested that teachers utilize workbooks to facilitate reading in mathematics lessons. This was also recommended by Tolentino (2019) as it is believed that the use of workbooks may be helpful in allowing students to complete a wide range of activities (including completing worded questions) that may assist in improving their reading skills at the grade seven level. In addition, Acedillo (2023) recommended that teachers make use of contextualized reading materials, such as texts or overall scenarios that will help students relate better to what is being read.

Teachers dealing with students who struggle in reading must ensure the tools are used as supplementary material to aid in word recognition and reading comprehension as this plays an integral role in developing their reading skills at the grade seven level. While it is a teacher's responsibility to ensure the aforementioned are achieved, much help needs to come from the home as it is reported by Mol and Bus (2011) that children who are taught to read before the period of formal training usually have a broader vocabulary and higher comprehension skills. Therefore, enhancement of their reading ability will be very effective if the support will come from the people around the students, not only in their school but also from their families.

2.4 Incorporation of Reading in Mathematics Lessons

King (2018) believed that reading is a powerful tool that must be used to its fullest potential in the mathematics classroom. According to Urquhart and Frazee (2012), reading involves one's ability to make sense of what is on a page of any resource (such as a book, worksheet, or spreadsheet) that may allow him or her to learn and apply mathematics. Leipzig (2001) argued that reading is a receptive skill since people are able to learn from it. That is, they can decode and make sense of print words, with the use of spoken words in order to pronounce the words in print. While this is so, Dunn (2012) discovered that for students across the various grade levels, weaknesses in their mathematics abilities are usually due to their struggle to decode these words, and symbols as they seek to read different text materials and also "the language of mathematics".

Mathematics is seen as a language of numerals, words, and symbols that may be used to communicate and solve problems (Dunn, 2012; Samuels, 2023). Many researchers have highlighted the importance of reading in mathematics lessons. Baber (2011) pointed out that reading in mathematics is unlike reading in many other content areas. This is so as it consists of its own kinds of literature, symbols, and formulas. Barton (1997) and Samuels (2023) declared that in addition to decoding words, Mathematics also requires students to be proficient in decoding numeric and non-numeric symbols. As a result, students must be able to shift from the normal routine of 'sounding out' the names of symbols (such as division and multiplication) and begin to recognize them by their respective symbolic representations ($\times$ and $\div$). Thus, with reading in mathematics, students may be able to learn basic reading skills, in addition to knowing how to use reading as a tool for thinking and learning mathematical concepts.

2.5 Knowledge of Vocabulary and Reading Comprehension in Mathematics

All content areas make use of their own words and terms. As a result, Bruce (2017) stressed the need for teachers to expose students to vocabulary in their content area. This author defined 'Vocabulary' to be the words that an individual is able to identify and know. Flohr (2010) described vocabulary to include the collocation of particular words in order to make a sensible statement. Nel (2012) contended that "Learners must understand math vocabulary

if they are to master content and be able to apply it in future situations". According to Imam (2016) and Samuels (2023), students become handicapped to learning mathematics if they are not aware of the routine vocabularies used in the subject area. The term that is used to describe the process involved in students learning these new terms unique to mathematics is "Disciplinary Literacy" (University of South Florida, 2023). Moje (2018) posited that this requires students to understand that there are words used in mathematics which may have a different meaning in other disciplines. For example, the word "difference" could mean "subtraction" in mathematics while in English Language, this means "contrast".

Reading comprehension is another skill that is important in mathematics classrooms. Butterfuss (2011) defined this to be the ability of an individual to construct a coherent mental representation of information in a text. According to Özcan and Doan (2018) and also Vilenius and Aunola (2008) reading comprehension is a powerful determining factor of students' performances in the subject area. These studies highlighted that students' computation skills developed to acceptable standards, however, they struggled to complete worded questions and this was due to the need for them to translate the words into numbers and mathematical symbols (relying greatly on the need to show comprehension of what was read). Contrary to this, a study conducted by Hijada and Dela Cruz (2022) revealed that comprehension skills are not enough to predict students' ability to solve worded mathematics questions which calls for a need to use other determining factors in measuring their performances. In this regard, Shanahan and Shanahan, (2012) stressed the need for teachers to assist students in learning how to learn, decode and use new words in their discipline. While this is useful in developing their writing skills, it is most useful in aiding comprehension- which helps students to work through mathematical problems (Wyra, 2019). However, Larson (2007) deduced that vocabulary plays an important role in reading comprehension, and hence- the understanding of mathematical concepts. Thus, incorporating reading in mathematics lessons may serve as a chance of improving students' vocabulary and this may play a significant role in how well they grasp mathematical concepts.

Incorporating reading in mathematics lessons may be underpinned by Vygotsky (1978) social learning theory and also Marie Clay's Emergent Literacy theory (1991) as they both see the importance of scaffolding in a mathematics classroom after the gaps in students' knowledge are discovered. This refers to the means by which teachers provide additional support to students in order to fill the learning gaps discovered. Reading is extremely important, especially for 21st century learners and professionals. While students at the grade seven level are expected to portray particular skills in reading, these skills may be affected by many factors- including students' interest and lack of reading materials, and lack of parental involvement in early stages of learning to read. Nonetheless, this may be achieved in multiple ways- including allowing students to practice using workbooks in mathematics lessons. Reading involves decoding, and so does mathematics. As such, reading in mathematics is vital as students will need to

decode worded materials (vocabulary) to their mathematical representations and this plays a major role in developing their comprehension skills. It must be noted, however, that comprehension skills is not the only determining factor for students' performance in mathematics and other factors should be taken into consideration.

3. Methodology

3.1 Research Design

For this study, the Quasi-Experimental Design was used. According to Harris et al. (2006) a Quasi-Experiment Study Design is one that evaluates the benefits of an intervention without using a random sampling method. It involves assigning subjects to a controlled and a treatment group based on non-random criteria (Thomas, 2022). The experiment involved the selection of 2 groups of Grade 7 students (the lowest performing grade 7 students). These groups were tested initially with a mathematics test assessment tool which involves worded questions and straightforward questions (See Appendix B). Students were also tested on the Ministry of Education's 2010 Informal Diagnostic Reading Inventory (See Appendix B). One group remained controlled while the other group was exposed to reading and comprehension strategies in mathematics during the lessons. At the end of the lessons, the students were assessed again to see any improvement in the students reading and mathematics skills. Both groups were taught similar content.

3.2 The Participants

For this study, the population was a group of approximately 285 Grade Seven students- distributed amongst 12 Grade seven classes. The age group of these students ranges from 10 years old to 13 years old. These are students who would have just completed their Primary Exit Profile Examinations and have just started their journey at the secondary level. A sample of 58 Grade 7 students were invited to participate in the study. This sample size is comparable to sample size in the similar study from MacDonald and Bane (2017). The sampling technique that was employed for this study is Purposive Sampling. Students at the Grade 7 level with challenges in reading and mathematics were already in a group according to the study setting environment. This group of students was selected because they fit the purpose of the study.

3.3 Data Collection and Data Analysis

The study was completed within 12 weeks. In week 1, a letter was written to the principal requesting permission to conduct the study at the institution. This letter outlined a brief introduction of the researcher and the study, the purpose of the study, how the data collected will be stored and utilized, stating participants are free to withdraw from the study at any particular time in time, and also a kind request for a response by the end of the week in keeping with the duration of the study. In week 2, however, the researcher selected the two grade seven classes to be included in the study. A letter, similar to the letter to the principal, was written to the parents requesting permission

for the students to take part in the study. The students were given this letter on Monday and were kindly asked to return the signed letter by the Thursday of the week to indicate their decision. Over weeks 3 and 4, on the other hand, the 2010 Informal Diagnostic Reading Inventory tool was used to test the reading levels of the sample of students. This gathered data on the initial reading level of the sample of students. The mathematics test assessment tool was administered to the sample of students which they were given 20 minutes to complete. The assessment tool consisted of 20 test items (2 marks each) and was completed by the participants. Between weeks 5 and 10, the incorporation of reading and comprehension strategies in the mathematics lessons began. By week 11, the students' reading, comprehension, and mathematics levels- after exposure to the intervention- were retested using the 2010 Informal Diagnostic Reading Inventory tool and the mathematics post assessment tool respectively. Finally in week 12, data analysis of the first and second research question was addressed through the illustration of Figures and Tables of the scores obtained by the students in addition to descriptive statistics. Inferential statistics such as the hypothesis testing using the independent samples t- test was used to address the third question.

Participants were advised that the data collected will be kept confidential. According to Ezra (2023), a Pseudonym is a fabricated name used to conceal the identity of an individual or a location. In this regard, the privacy of data was maintained using pseudonyms to represent each participant of the study. Also, data was kept in a secure folder- only accessible to the researcher. Data was also uploaded to a

computer into a password protected folder for safekeeping. This was only be accessible by the researcher. Participants were also advised that they are allowed to withdraw from the study at any given time without discrimination- even if they had initially given consent to partake in the study. Additionally, after the study, the comparison group were exposed to the intervention to ensure all students were treated equally.

The data in this study were records of the students' test scores from the assessments given to the students in the experiment. The student demographic information was also recorded as part of the data in the study. Students were given two assessment tools. One of the tools focused on the students' reading and comprehension level and the items were drawn from the Ministry of Education's 2010 Standard Informal Diagnostic Reading Inventory. The next test assessment tool focused on mathematics skills and the test items were developed as part of the tool of data collection. A 10-item test paper was designed, which consisted of 5 straightforward test items (2 marks each), and 5 structured test items with (2 marks each). These worded items sought to measure participants' ability to read and understand written instructions, and worded questions, represent worded statements or questions using their respective mathematical statements, and also their ability to use the correct computation skills to find the solution of worded and also straightforward mathematical test items. The mathematics score was measured against the pass mark (50%). Thus, students who score below 50% were considered to have challenges with mathematics at their grade level.

The formula used to calculate the percentage of students who struggled with both reading and mathematics skills was:

$$\text{percentage of students who struggle with both reading and math skills} = \frac{\text{\# of participants struggle with both reading and math}}{\text{total number of students in sample}} \times \frac{100}{1}$$

To ensure the study is valid and reliable, the mathematics test assessment tool was checked by a mathematics expert to ensure that the items are directly linked to the objectives of the study. Also, an expert in the field with experience using the Ministry of Education's 2010 Standard Informal Diagnostic Reading Inventory was asked to supervise a pilot test of the tool using 3 students. Additionally, the appropriate sample size was used since a t-test was used to check for statistical differences, if any, between the variables based on the results achieved.

The first research question was addressed by constructing a table of descriptive statistics using the participants' scores from the first test assessment tool. The second and third research questions were analyzed using inferential statistics of paired samples -t test to identify any significant difference between the students' score before and after the exposure to reading and comprehension skills. The independent samples t-test was used for the third question to investigate the relationship between students' performance in Grade 7 mathematics and their exposure to different reading and comprehension skills. Statistical Package for Social Science (SPSS) software was used in the analysis.

4. Results

4.1 Results Based on Research Question 1

What is the percentage of students in the selected sample that have challenges reading and also poor in Grade 7 mathematics?

This research question provides an analysis varied number of students who had difficulty reading in a grade 7 mathematics classroom, as well as comprehending basic mathematics concepts to uncover reasons for their poor mathematics performance. The mathematics areas focused on basic operations, including addition, subtraction, multiplication and division; and problem-solving activities such as number sentences and money applications. While the reading activities comprised reading word lists and comprehension passage to complete comprehension questions; as well as oral reading tasks. The study revealed that three percent (3%) of the students were unable to read at the appropriate grade 7 level but were able to achieve over 50% on their mathematics diagnostic test. This indicates that despite a small number of students having literacy issues, they are equipped with sufficient

mathematical reasoning skills. This might be due to them possessing stronger procedural or rote-learning abilities.

However, only five percent (5%) of the participants were able to achieve over 50% on their mathematics pretest but had challenges achieving targets on their reading tests. This suggests that students exhibit signs of some level of mathematical competence independent of having strong reading proficiency. Three percent (3%) of the participants had no challenges with the subjects. This therefore shows that approximately 87% of the students who had challenges achieving over 50% on their pretest also had challenges reading at the grade 7 level. This indicates a strong overlap suggesting that there is a direct relationship between students' mathematics performance and their reading ability, especially as they complete tasks such as money-related ones and worded problems requiring them to comprehend the written information.

Table 1: Frequency of participants who struggled with reading (R) and mathematics (M)

Challenges	Frequency of students	Percentage of Students
Having reading challenges only.	2	3%
Having basic math challenges only.	3	5%
Having both reading and basic math	51	87%
Having no challenge with math nor reading	2	3%
Total	58	100%

The findings emphasized that the challenges students have with reading, comprising performing oral reading, understanding comprehension passages, and decoding word lists, may be key barriers for students to develop their abilities to interpret and solve mathematics problems at the grade 7 level.

4.2 Results Based on Research Question 2

What is the performance of students in Grade 7 mathematics before and after the exposure to reading and comprehension skills?

This section presents an analysis of the data collected from pretest and posttest assessments given to students that focused on basic operations, including addition, subtraction, multiplication and division; and problem-solving activities through number sentences and worded questions. Table 2 illustrates the results of the pre-test and post-test. Before the intervention, participants of the study had a mean score of ($M=35.2$) with a standard deviation of ($SD=15.8$). The maximum score that each participant could achieve was 100. After the intervention, their mean score recorded was ($M=33.6$) with a standard deviation of ($SD=14.1$). The mean difference between the pre and post intervention scores was 1.7 with a standard deviation of 9.8. This indicates there is a small change in students' mathematics performance.

Table 2: Students' mean score and standard deviation on pretest and posttest

Assessment	Mean	Standard deviation
Pretest	35.2	15.8
Posttest	33.6	14.1

A paired samples t-test done showed no statistically significant difference in scores $t(28) = 0.907$, $p > 0.001$. The effect size was 0.168. This implies that the reading and comprehension intervention had a small effect on students' mathematics performance. The 95% confidence level ranged from -2.08323 to 5.39357, revealing that the intervention had no statistically significant effect on the participants' scores. Overall, the findings suggest that the intervention might be short-term requiring more time as well as more targeted reading activities especially with a focus on mathematics vocabulary and literacy-numeracy instruction.

4.3 Results Based on Research Question 3

Is there any relationship between the performance of students in Grade 7 mathematics and the exposure to reading and comprehension skills?

This question examined the effects of incorporating reading and comprehension strategies and participants' ($N=58$) performances in Grade 7 mathematics. To do this, an independent samples t-test was done to compare the scores of students who were exposed to the intervention to those who were not exposed to the intervention to see if there are any statistically significant differences in the scores (see table 3). The participants who were exposed to the intervention had a mean of ($M=33.6$) with a standard deviation of ($SD=14.1$). The scores of the participants who were not exposed to the intervention resulted in a higher mean value as ($M=35.6$) with a standard deviation of ($SD=2.1$). The magnitude in the differences of the means is ($M=-2$). The 95% confidence level interval ranged from -8.71208 to 4.85001 which shows no statistical significance in the means of the scores.

This reveals that the intervention was not significant in improving students test scores which may be attributed to the short duration of the study. Hence, the research fails to reject the null hypothesis since there is no statistically significant difference between the performance of students who are

Table 3: Descriptive statistics for controlled group and experimental group

	Controlled Group	Experimental Group
Mean	35.6	33.6
Standard deviation	14.1	2.1
Observations	29	29
Mean difference	-2	
df	56	
t-statistics	-0.570	
Confidence level interval range	-8.71208 to 4.85001	

exposed to reading and comprehension skills and students' performance in Grade 7 mathematics. Nonetheless, the

study indicated that despite marginal the students did perform slightly better following the intervention, therefore there is potential benefit in using reading intervention strategies if over the long term. Additionally, this marginal difference may be influenced by external factors including students' prior knowledge, reading abilities individually or even teaching methods.

4.4 Further Discussions and Implications

The first research question examined students' reading and mathematics abilities by testing to determine how many students struggled with both reading and mathematics at the Grade 7 level. The results were alarming as it was discovered that approximately eighty-seven percent (87%) of the sample of students had challenges achieving over fifty percent 50% on their mathematics pretest together with challenges reading at the grade 7 level. According to Espiel and Carretero (2022), reading is a language-based activity that is not developed naturally, and for many children, specific decoding, word recognition, and reading comprehension skills must be taught directly and systematically. Vygotsky's 1978 theory introduced the phrase 'zone of proximal development' to be the gap between what students know and also what they can learn; and also, the term 'scaffolding' which is the additional help rendered to students to bridge the gap present (the zone of proximal development). In this regard, the results from this study have highlighted a massive learning gap since students' still face challenges achieving their grade level reading skills or to function mathematically at the appropriate grade 7 level. Based on Vygotsky's 1978 theory, the correct level of scaffolding could help to bridge these gaps in an effort to improve students' performances.

A major highlight from the study was that not all students were at the same reading level. This is in agreement with Wepner et al., (2013) who believed that learning to read is a multifaceted process in which students may learn to do so at different stages of their lives- with or without additional assistance. While this is so, there are certain aspects of reading that students should be able to do at the grade 7 level and according to Pellissier (2022), being able to read text materials to determine facts and draw conclusions is one major aspect that they should be able to do. However, the sample of grade 7 students struggled drastically with this.

Another highlight was that of the sample of students (N=58), 53 of them struggled to read at the appropriate grade 7 level. One reason for this could be due to their exposure to reading in their early years- or lack of (the emergent literacy theory). In this regard, Jose and Raja (2011), stated that reading in the early stages of students' life is important and must be taken seriously by teachers (including parents) to ensure that students are not flustered and get full clarifications when needed since once their love for reading had disappeared, their ability to excel in the skill becomes even difficult in later years. Mol and Bus (2011) also agreed as they believed that children who are taught to read before the period of formal training usually have a broader vocabulary and higher comprehension skills. Coupled with the students reading below the appropriate

grade level was the issue of poor mathematics performances. Of the sample of students (N=58), 53 students had challenges achieving 50% on their mathematics pretest. Dunn (2012) discovered that for students across the various grade levels, weaknesses in their mathematics abilities are usually due to their struggle to decode these words, and symbols as they seek to read different text materials and also "the language of mathematics". Thus, students' reading and mathematics abilities could be closely related.

The second research question examined the effects of incorporating reading and comprehension strategies in lessons on students' performance Grade 7 mathematics- comparing performance results before and after the intervention. The results showed that incorporating reading and comprehension strategies into mathematics classrooms did not have any statistically significant impact on students' performance ($p=0.372$). This means that students' performance in Grade 7 mathematics was not improved after exposure to the intervention. Jose and Raja (2011) believed that reading in early years is crucial to students' ability to read and comprehend in the future. However, over 90% of the sample of students entered grade 7 were reading below their grade level. Similarly to the percentage of students who were unable to read or comprehend at the appropriate grade 7 level, approximately 91% of the sample of students also struggled in mathematics. Dunn (2012) and Samuels (2023) discovered that for students across the various grade levels, weaknesses in their mathematics abilities are usually due to their struggle to decode these words, and symbols as they seek to read different text materials and also "the language of mathematics". Thus, since students may have had poor exposure to reading and comprehension skills in early years, this may now be impacting how open they are to learning the subject; and also, how fast they can learn- which lowered the effectiveness of the intervention and its ability to improve their mathematics skills due to the short period of time they were exposed (4 weeks).

The above closely relates to the final research question, which examined whether or not a relationship existed between students' mathematics performance and the incorporation of reading and comprehension skills in the mathematics lessons. Due to the p value being greater than 0.05, there was little evidence available to show that the integration of reading and comprehension strategies in the mathematics lesson was effective in improving students' mathematics skills. While Özcan and Doan (2018) and also Vilenius and Aunola (2008) believed that reading and comprehension skills are powerful determining factors of students' performances in the subject area, Imam (2016), posited that students become handicapped to learning mathematics if they are not aware of the routined vocabularies used in the subject area; and also Moje (2018) posited that excelling in mathematics requires students to understand that there are words used in mathematics which may have a different meaning in other disciplines. Also, Hijada and Dela Cruz (2022) revealed that comprehension skills are not enough to predict students' ability to solve worded mathematics questions which calls for a need to use other determining factors in measuring their performances.

Here are some implications to consider based on the findings:

- ❖ To include behavioral modification strategies in mathematics lessons in order to enhance the students' ability to focus more on their reading and mathematics performances at all grade levels, with emphasis on the Grade 7 level.
- ❖ Teachers can involve parents in students' learning experience while planning mathematics lessons, which may allow students to get more practice in reading and also mathematics outside of the classroom.
- ❖ Schools could implement mandatory mathematics and reading comprehension extra classes or workshops for students who perform below the appropriate reading or mathematics level. This may serve as an effort to improve their chances of being academically successful in both areas- among other subject areas.

5. Conclusion

The study has highlighted that 87% of the students' reading and mathematics abilities were below the grade level. The findings of this research also highlighted that the intervention did not impact students' performance, as there was no improvement in students' averages before and after the intervention. Further checks have helped to discover that the incorporation of reading and comprehension strategies in mathematics lessons had no significant impact on students' performance in the subject area. Future studies should investigate longer-term interventions, integrate literacy more explicitly into numeracy frameworks, and assess teacher training in these integrated pedagogies.

6. Recommendations

Based on the findings, the following recommendations can be utilized for future research and improve pedagogy:

- ❖ The Ministry of Education could host professional developments centered around the importance of reading, especially at the Grade 7 level. This could also include mathematics and the link between these two subject areas. These professional developments may help teachers to plan and execute lessons effectively so that students may grasp concepts better- leading to improved student outcomes in these areas.
- ❖ Schools should be provided with a variety of reading materials, including text books, articles, and digital resources that may assist teachers in to better expose their students to different mathematical contexts and applications.
- ❖ The Ministry of Education should design curriculums that promote the integration of reading and comprehension skills in all subject areas and also promote mathematical skills through practical real-world applications. These practices may help students to develop their reading skills as they receive more practice in all subject areas. Also, being able to read and understand real world mathematical statements may prove useful in enhancing students' overall performances in the subject area as they are better able to relate to the subject area.

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