

# **ANALYZING GRADE 4 LEARNERS' MATHEMATICS EXERCISE BOOKS IN PURSUIT OF QUALITY BASIC EDUCATION IN NAMIBIA**

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## **ABSTRACT**

This paper presents the findings of a qualitative study that focused on the state of grade 4 learners' mathematics exercise books. Identification of challenges in mathematics learning in early grades presents the opportunity for early stakeholder intervention to improve the quality of basic education. The random sampling strategy was used by the subject teacher to select fifteen books from one class comprising 5 below-average, 5 average, and 5 above-average learners for analysis. The document analysis method was used to establish the status of learners' written work, how well the work was written, and to establish their performance in mathematics. This study found that learners' writing skills are underdeveloped, they have challenges pertaining to comprehension of instruction and challenges in learning specific mathematics topics. The quality of mathematics written work is generally neglected in school, as mathematics learning is perceived to be a process that focuses on the acquisition of facts. This study confirms that the quality of learners' written work has received little attention from relevant stakeholders. The state of learners' written work calls for immediate intervention to improve mathematics learning.

## **INTRODUCTION**

Early mathematics education impacts learners' progress and performance in subsequent grades. The mathematics learning process involves numerous skills which include mastery of mathematical facts through communication. Skills such as reading, listening, speaking, and writing are critical for learning mathematics successfully. This study focuses on the quality of learners' written work as writing is one of the key modes through which learners and teachers communicate ideas in a mathematics classroom. Since thinking is an internal process that cannot be seen, writing enables learners to represent the thinking processes used to perform calculations and to keep track of their thoughts (Pugalee, 2001; Hartnett, 2007; Vygotsky, 1962). Research has found that the quality of learners' written work directly affects their performance in mathematics (Dündar, 2016). Owing to this, it is essential for learners to write

clearly for a better understanding of what they have written. The interest to improve the quality of mathematics learning prompted the researchers to explore learners' written work and the challenges encountered.

In light of that, the study aimed to analyze grade 4 learners' mathematics written work by looking critically at learners' mathematics exercise books to see what is written, how it is written, how well the work is written, and how learners are performing in various mathematics topics. Analyzing learners' work is imperative for laying a solid mathematics foundation for learning advanced mathematics. Literature shows challenges in learning mathematics begin in early grades and continue in upper grades (Gersten et al., 2005). A study conducted in Namibia by Shigwedha et al. (2015) indicates that despite Namibia's major financial investment in education, outcomes of education remain a problem as few learners reach advanced mathematics levels in upper primary.

Similarly, statistics of the school involved in this study, on grade 4 learners' mathematics performance at the end of the 2021 academic year; indicate that out of 390 learners who wrote exams only 69 (17%) of the learners obtained A, B, and C symbols. The rest (321) obtained a symbol below C. A study conducted by the University of Namibia, United Nations Educational, & Funds-in-Trust (UNUNEFT), 2014) found that one of the factors affecting mathematics performance in early grades is the teaching methods used by teachers. This study focused on grade 4 mathematics teaching and learning to bridge the gap of limited research conducted on grade 4 level compared to other grades, particularly this study focused on learners' written work.

Furthermore, this study set to discover any other issues that could be hampering grade 4 learners' performance in mathematics. Identification of challenges may contribute towards the improvement of grade 4 mathematics teaching and learning. In other words, the study was conducted to establish the state of mathematics exercise books to identify any learning issues requiring stakeholders' attention and intervention.

### **LITERATURE REVIEW: Learners' written work in mathematics exercise books.**

Writing is inevitable in a mathematics classroom for it is a means through which learners communicate their mathematical thoughts and understanding to teachers. Meanwhile, teachers use writing to communicate instruction, mathematical concepts and procedures to learners as English language is a medium of instruction, in grades beyond grade 3, in Namibia. On one

hand, writing can support learners to comprehend mathematical concepts and procedures (Sarwat et al., 2021). On the other hand, it has been established that writing in a mathematics classroom can contribute to mathematical learning difficulties (National Council of Teachers of Mathematics, 2000). In the case of grade 4 learners who are in a transitional period, particularly learners that learned mathematics in their mother tongue in previous grades, may not only experience writing problems but will also have issues regarding English language comprehension. As a result, learners' comprehension of mathematical concepts and procedures may be hindered, resulting in mathematics learning difficulties.

Generally, language comprehension is critical as it is used to transmit mathematical ideas (Martínez, 2019; Jankson, 2022). Thus, challenges in English language comprehension can affect learners not to understand what is expected of them. As a result, learners will provide wrong answers or avoid the question. Written information is worth considering as hazy work cannot be read either by learners themselves parents or teachers and may negatively affect performance. Also, when learners copy instructions wrongly they will provide wrong answers and it will be difficult for parents to assist the learners at home. A study that investigated literacy and numeracy skills at the elementary phase, found the following issues about writing skills: spacing, punctuation, sitting position, and hand and eye coordination were highlighted as challenging to learners (NIED, 2012). Aspects such as spacing and punctuation are key to writing.

When learners fail to master effective writing skills, it becomes difficult for them to comprehend instruction or to communicate their mathematical ideas clearly to the teachers as words are not well structured making it difficult to read. Arthur et al. (2017) underscored, it is through words both teachers and learners make known their mathematics thoughts. Findings in the study that explored the spelling scores and mathematics scores in early grades suggest that a low level of spelling has a direct effect on mathematics performances (Wolfe, 2005). This implies learners' spelling experiences are related to their scores in mathematics. For example, a learner with a high level of spelling skills is at an advantage of transferring the good skill into mathematics performances whereas, the ones with a low level of these skills are likely to yield low performances in mathematics.

Numeracy and literacy skills are intertwined, hence, it is important for educators to strive towards achieving high competencies in literacy and numeracy development. Writing in

mathematics has proven to be challenging to children mostly during their early academic lives. Challenges emerge because children learn mathematics when they are at the same time acquiring how language is used (Machaba, 2021). This process often causes children to experience a heavy load on cognitive processing. It is therefore worth noticing that there is a necessity to understand such challenges by examining learners' exercise books. Henceforth, early intervention is needed to identify the learners at risk of mathematics writing for better academic performances. According to the study by NIED (2012), some learners' performance is undesirable as teachers do not strike a balance between literacy and numeracy. However, engaging learners in a variety of reading and writing activities both at home and at school can enhance literacy and numeracy skills. Learners need to acquire reading and writing skills not only to communicate their mathematical thinking but to enhance their conceptual understanding of the subject. With this in mind, basic quality education in grade 4 learners can be improved.

## **RESEARCH METHODS AND DESIGN**

A qualitative research design was used to analyze learners' exercise books. A qualitative design was found relevant for this study to generate detailed information about challenges hampering grade 4 learners' learning of mathematics (Creswell, 2015). The population comprised grade 4 learners. The researchers obtained written permission from the Director of Education of the Kavango-East region and the principal of the school before conducting the study. Written permission was also granted by the Decentralized Ethical Clearance Committee of the University of Namibia – Rundu campus.

Initially, the researchers intended to analyze the grade 4 mathematics syllabus and teachers' scheme of work but it was not done due to time constraints. As a result, only learners' books were analyzed to identify learning challenges. Fifteen books were analyzed to establish how learners are performing in different topics and to detect other factors hindering learners' performance in mathematics. A total of fifteen books were collected from three classrooms taught by three different teachers, teaching grade 4 mathematics, but this paper reports on findings of one classroom comprising 37 learners.

Random sampling was used by subject teachers to select books of any 5 low-performing learners, 5 moderate performers, and 5 high performers in mathematics. In the sampling strategy, two teachers used a class list and ticked any learner they could think of but one teacher

listed the learners on a piece of paper. Data was collected through a document analysis process. The data analysis strategies used were content and thematic analysis strategies through the coding of text to highlight common issues identified in learners' books that translated into themes and codes. Themes comprised of the three main issues detected in learners' books whereas the nature of mistakes is the codes. The study also looked at how work is done and evidence of support received from the teachers. The information was summarized into codes and tabulated to illustrate the challenges related to English language writing and mathematics performance.

## **FINDINGS**

The purpose of this study was to establish the state of grade 4 learners' written work as it appears in their mathematics exercise books. Findings are summarized into three themes: i) Quality of written work, ii) English language comprehension, and iii) mathematics topics learners found challenging (where scores are below 50%). Besides issues pertaining to writing, the study also identified issues pertaining to conceptual knowledge and English language comprehension that lead to misunderstanding of instruction. The specific issues under each of the three themes formed the codes of the results of the study.

### **General issues**

Other important aspects that were identified, besides issues of writing and mathematics conceptual knowledge development, include untidy work where mistakes are canceled by scrabbling over the word many times until it forms a dark spot, incomplete classwork,

incomplete homework, not underlining work and underlining work without a ruler and inadequate work covered by some learners. Figure 1 displays a learner's work that is untidy.

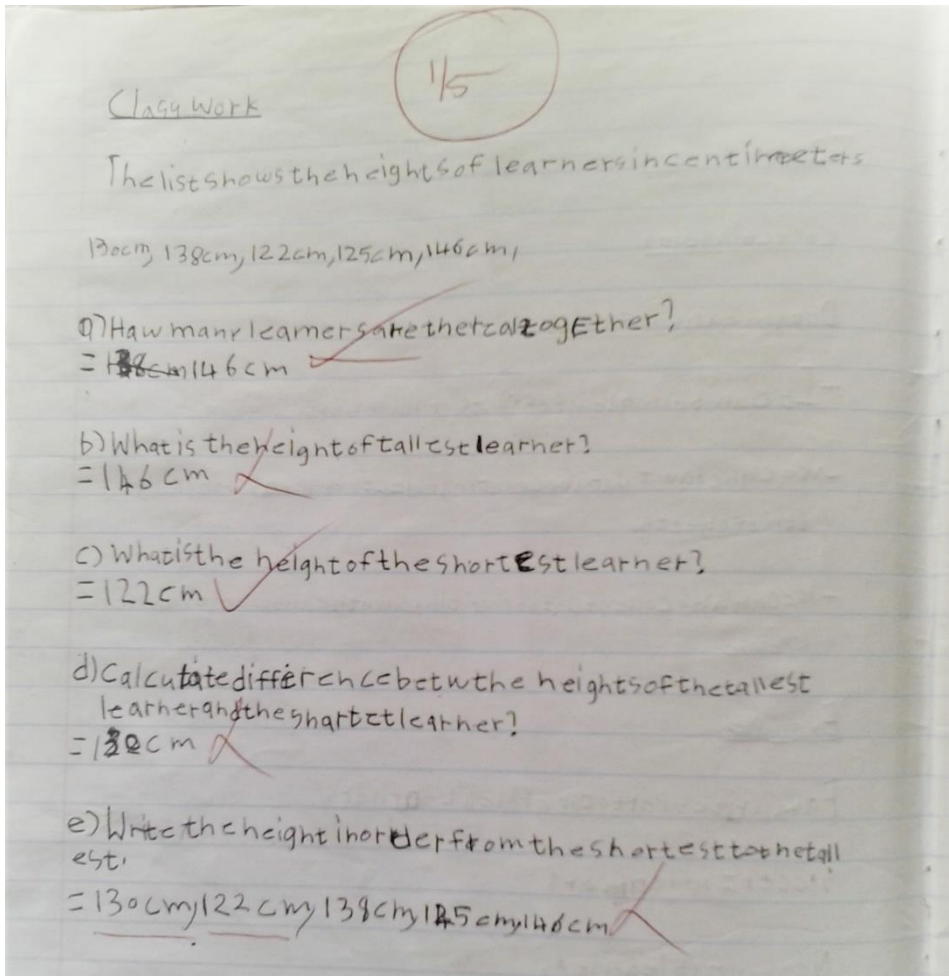


Figure 1: A sample of a learner's work with challenges of legible writing.

Aspects relating to spelling were also identified as displayed in figure 2. Figure 2 presents a homework sample of a learner struggling with spelling when writing numerals in words.

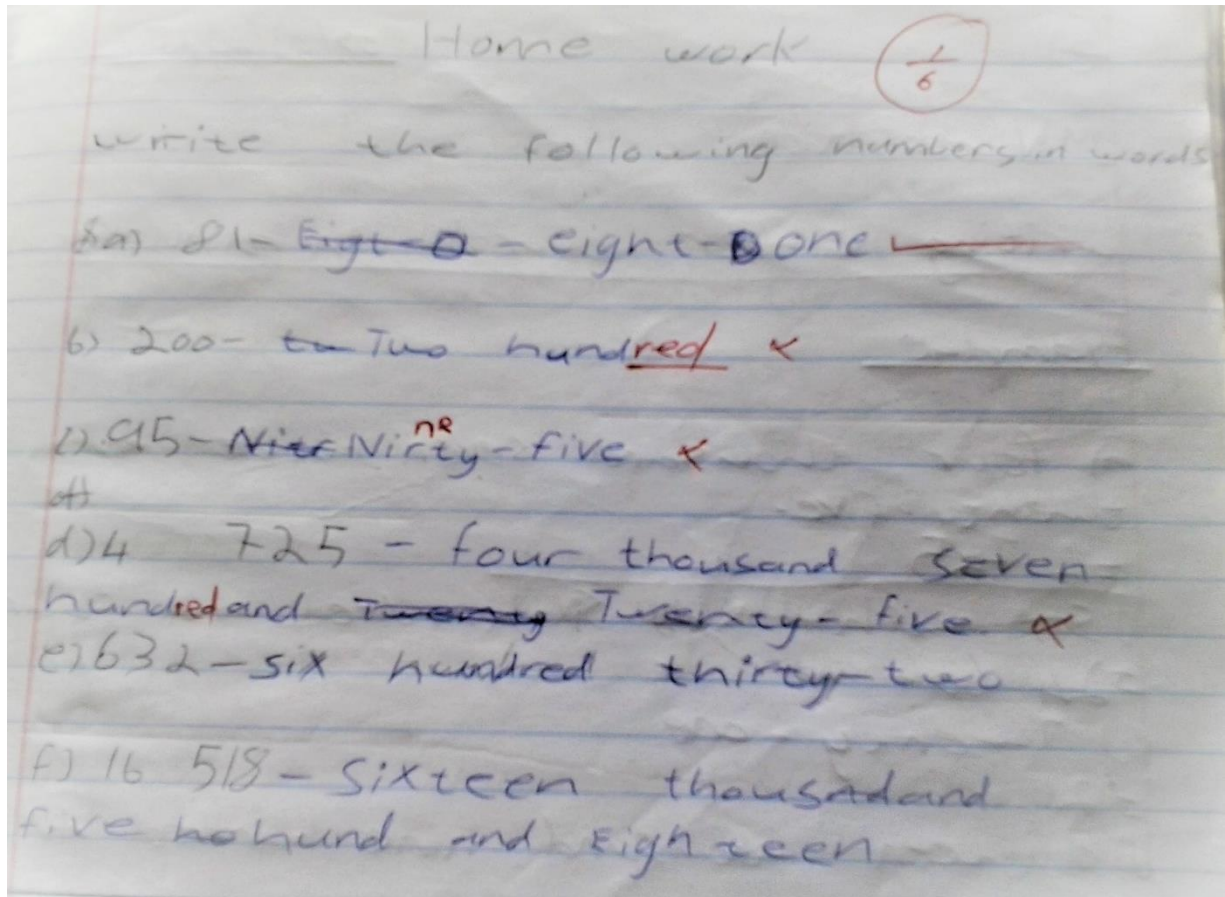


Figure 2: A sample of one grade 4 learners' work depicting the challenge of spelling when writing numbers in words.

In answering the first question presented in figure 2, the learner writes 81 in words as 'eight-one' instead of writing 'eighty-one'. In the second question, the learner writes 200 as two hund and in the fourth question '... 700' is also written as 'seven hund' but in the fifth question '632' is written correctly as 'six hundred thirty-two'. However, the mistake 'hund' is again repeated in the last question. Another spelling mistake is reflected in the third question where '95' is written as 'nirty-five'. A presentation of issues regarding writing and English language comprehension is discussed next.

### Aspects pertaining to writing and English language comprehension

Fifteen key issues about writing were identified in learners' books. English language comprehension was also identified as an aspect hindering mathematics learning. Table 1

includes the aspects that were discovered regarding writing and English language understanding. The aspects in Table 1 are not ranked in any order.

**Table 1: Quality of writing and English language comprehension**

1.	Incorrect spelling of words, e.g. (Book 6: collect dadas/dafas, coutirgdoun, fawaurut,
2.	Inability to write own name correctly (Book 13: ‘Kamduta instead of Kambuta’
3.	Starting a sentence with a lower case letter.
4.	Writing a capital letter in the middle of a word (Book 7: data)
5.	Ending a word or sentence with a capital letter (Book 7: neareasT, heighT)
6.	Very big or very small handwriting (Book 7)
7.	Date not written sometimes.
8.	Incomplete notes or words – book 9. (Is it a writing pace problem or what? Book 5: backward, forwourate, correction, eges of learners ina class, lerner, exerase (exercise), tallay lines, defferent, twonty (teacher corrects it – underlines mistake and writes ‘e’ on top of ‘o’).
9.	Instruction copied wrongly (Book 6: 06 March 2022 - how does a parent assist and learner fails task –does the wrong thing?)
10.	No space between words.
11.	Split words (Book 7: re pre sent, home work, picto gram) book 15: large space between letters of one word.
12.	Joining many words together and very untidy work, book 9
13.	Topic written/not written? Pending – check learners’ books again.
14.	Misunderstanding of instruction on 01 March 2022 - 1/6 (Importance of clarifying instruction)
15.	English homework written mistakenly in mathematics (Attentiveness; book 14: book (14/01/2022).

The study found that the overall quality of written work is untidy and needs improvement. Issues about English language comprehension is evident in learners’ books, e.g. ‘Calculate the difference between the masses of the heaviest and lightest lambs’ (book 14 tasks done on 12/01/2022). Also, figure 3 displays work of a learner experiencing difficulties with English language comprehension.



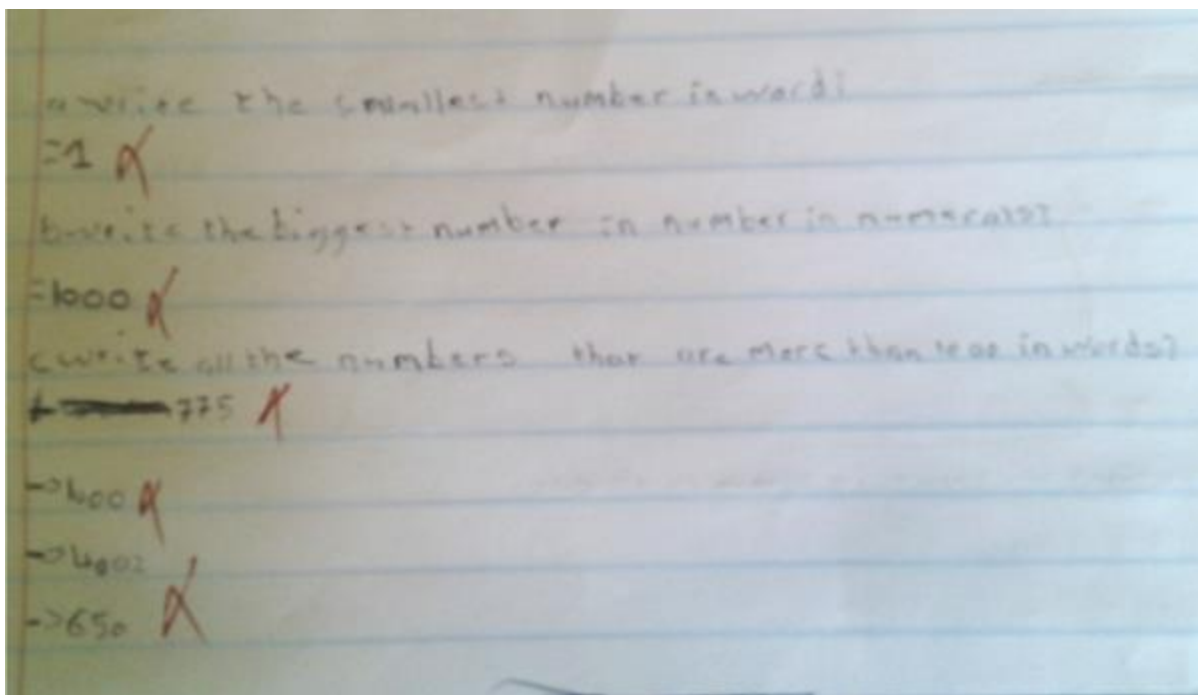


Figure 1: A sample of a learner's work depicting issues of language comprehension.

In Figure 3, in answering the first question, a learner wrote the smallest number in numerals instead of writing it in words as instructed by the teacher. The same thing is done to answer the third question where the instruction says ‘Write all the numbers that are more than one in words’. Instead of writing words, the learner wrote numerals. In this case, a teacher must ensure that all learners understand what to do by interrogating them individually to explain what they are expected to do. Issues regarding conceptual knowledge development are discussed next.

**Aspects pertaining to mathematics conceptual knowledge development.**

As to mathematics learning, the eighteen key aspects discovered are outlined in Table 2. Similarly, mathematics topics presented in Table 2 are not ranked in any order. The topics in Table 2 are the ones where learners scored below 50% of the total marks of the class activity and homework written in their exercise books.

**Table 2: Mathematics topics learners found challenging.**

Challenging Mathematics topics (Topics not ranked in any order).	
1.	Reading data on a tally sheet (data handling). Book 9.
2.	Recoding data on a tally table.
3.	Reading a bar graph and pictogram to answer questions and difficulty of understanding the key of a pictogram.

4.	Whole numbers – counting from a specific number to the next number as indicated e.g. from 25 to 20 and from 125 to 185.
5.	Counting backward in 25s or in 10s from a specific number, e.g. counting backward in 9s from 200 to 25 and from 300 to 200.
6.	Identifying odd numbers from listed numbers.
7.	Value and place value.
8.	Filling in missing numbers on a number line.
9.	Rounding off to the nearest 10,100, 1000.
10.	Ordering and comparing - relationship signs, ascending order.
11.	Describe each pattern in words. Describing patterns in words - 14/04/2022 (Capture the text to insert in the article).
12.	Create your own number pattern that has 5 terms.
13.	Write the value of the underlined digit e.g. 3 <u>7</u> 24 = 100, <u>9</u> 65=100, 2 <u>7</u> 16=100, 4 4 <u>3</u> 3=103 (04 March 2022),
14.	Correction is not done sometimes by a few individual learners.
15.	Comparing mass.
16.	Expanded notation.
17.	Writing numbers in words.
18.	Estimation and actual amounts, book 14 28/03/2022

The topics listed in table 2 were found to be challenging to most of the 15 learners whose books were analyzed. However, the teacher employed specific measures to improve learners' performance in the topics that were covered as presented in the next section.

### **Teacher intervention**

The study found that the mathematics teacher communicates extensively with learners in writing through written feedback provided in learners' books. Writing is used to acknowledge good performance using remarks such as 'good, excellent, push, work hard and poor. The teacher also pastes stars in learners' exercise books to award high-performing learners. Also, slow learners are encouraged to work hard in order to improve individual performance in mathematics, quality of handwriting and to write neatly. The teacher also encourages learners not to omit space when writing on a different page if space is available on the previous page. Spelling mistakes are corrected e.g. a learner who had written 'twenty' as 'twonty' is corrected

by underlining the mistake and the teacher writes 'e' on top of 'o'. As to other mistakes, the teacher writes the complete word, e.g. 'petterns' the teacher writes 'pattern'. The teacher also reminds learners to write the date, e.g. 'Date!', 'underline your work with a ruler and complete activities given', and 'learn how to write properly'. The approach used to correct learners can be very effective but challenging when dealing with a large group of learners.

## DISCUSSION

This study was conducted to establish the state of grade 4 learners' mathematics exercise books to identify appropriate interventions to address the problem. Findings thereof indicate that learners whose books were analysed have challenges about writing and mathematical knowledge which the mathematics teacher attempts to address through written comments. However, early intensive intervention involving different stakeholders is necessary to address learners' inappropriate writing skills, lack of comprehension of instruction, and challenging mathematics topics to improve their performance in mathematics (Dündar, 2016; Sarwat et al., 2021). Although learners have challenges, it is evident from their exercise books that adequate mathematics written work was covered in semester one of the academic year, that extended from January to April 2022.

Results further indicate that learners have the opportunity to improve in a specific topic. The study found that the teacher provides more than two different tasks based on the same topic. This was evident in one learner's book who scored 0/8 in the first task on place values but obtained 9/10 in the third task on place values. However, the implication to teaching practice is that repetition of a topic may delay the teacher from covering all the topics outlined in the lengthy grade 4 mathematics syllabus timely or force the teacher to teach fast in order to teach all the topics. Results also reveal that if issues pertaining to English language comprehension and writing are not addressed mathematics learning will be affected. Therefore, this study calls for revision of the grade 4 mathematics syllabus to minimize the number of topics. Teaching an adequate number of topics will afford teachers adequate time to support learners without rushing to complete the syllabus and compromise understanding of mathematical concepts and procedures.

The limitation of this study is that only one class is discussed in this paper hence, the findings cannot be generalized to the entire grade 4 learners. However, the study highlighted potential issues other grade 4 learners and teachers could be experiencing in class. Additionally,

measures used by the mathematics teacher to address particular issues can be used by other teachers as well to address similar challenges. Furthermore, this study does not entirely attribute challenges pertaining to mathematics topics on English language comprehension as learners were not interviewed and mathematics lessons were not observed. However, it is evident from the exercise books that learners' writing skills in mathematics need improvement.

## CONCLUSION

One of the objectives of a major study from which this paper emerged is to determine the state of the written work of grade 4 mathematics learners' exercise books. A considerable number of issues pertaining to grade 4 learners' mathematics performance discovered by analyzing learners' written work were found in their mathematics exercise books. Issues identified relate to the quality of written work, understanding instruction written in English which is used as a medium of instruction, and difficulty in learning particular mathematics topics. The evidence from learners' exercise books confirm that comprehension of instruction and the quality of learners' written work can affect the performance of learners in mathematics. Also, the findings of the study indicate that there is a need for intervention to improve learners' English language comprehension, writing skills, and mathematics concept learning. Therefore, the recommendation is made for mathematics teachers to address writing skills as opposed to focusing on the learning of mathematical concepts and procedures only.

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