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# The Impact of Challenges Experienced by Teachers and Learners on Mathematics Performance in Relation to their Socio-Economic Standing

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## ABSTRACT

**Objective –** This paper explores the challenges experienced by mathematics teachers and learners of seven high schools in South Africa. A mixed method approach involving interviews and questionnaires was used.
**Methodology –** The sample included 7 principals or deputy principals, 7 departmental heads who supervised mathematics, 1 mathematics teacher who taught mathematics in grades 10 to 12, and 1 mathematics teacher who taught Mathematics in grades 8 and 9. In addition, 1 learner from each grade 8 to 12 was included in the sample. Each participant was interviewed using a structured interview schedule, followed by participants completing a questionnaire.
**Findings –** Vygotsky's socio-cultural and conceptual development theories in mathematics education formed the basis of this study. The 'Inputs, Processes and Output" model of Howie and Kilpatrick's model of the five strands of achieving 'mathematics proficiency was adopted. We identified many systemic, societal, and pedagogical challenges that teachers and learners experienced, which affected their mathematics teaching and learning. Our findings correlated with research in the literature review.
**Novelty –** The researchers concluded there were always intervention strategies that could assist in minimizing or eradicating the challenges faced by the teachers and learners of mathematics, thus improving their socio-economic standing.
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***Keywords***: Challenges, Strategies, Blended Learning, Scaffolding, Conceptual Development, Collaborative Learning.

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## 1. Introduction

This paper sets out to ascertain what challenges learners and teachers experience that affect learners' mathematics performances. Parents expressed concern that the poor mathematics pass rate denies their children the opportunity to enroll in mathematics and science-related courses at institutions of higher learning.

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Literature tells us that high school learners' mathematics performances are directly related to a nation's scientific and technological improvement and that their competence in mathematics and the sciences are essential for their social and economic standing (Mahmood et al., 2012) (et al. Reddy, 2015). Furthermore, the 2015 TIMMS report states that the slow level of change in the contextual conditions contributes to the levels of poverty and nature of inequality in the country, and this rate of change is insufficient to meet the educational expectations and needs of the country (V. Reddy et al., 2016). In the 2019 TIMMS report, Reddy, et al. conclude that the rate of improvement in mathematics has declined (Reddy, V., Winnaar, L., Juan , A., Arends, F., Harvey, J., & Hannan, 2020).

Upon analysing the Grade 12 National Senior Certificate Results for the period 2016 to 2019, the researchers found that the performances of learners in mathematics have adversely affected the overall pass rate of Grade 12 learners, within each high school, in the Phambela Circuit.

Therefore, challenges must be identified and minimised or eradicated by possible intervention strategies. In this context, the researchers set out to explore the challenges that impact learner mathematics performance, as this is seen as an impediment to improved mathematics pass rate, which has implications on the overall pass rate of the schools.

## 2. Literature Review

The researchers explored past literature that identified challenges for the teaching and learning of mathematics. A significant contribution to the difficulties was the past apartheid policies of the Nationalist Government which focused on white control, providing the majority with inferior Education to exercise control and power. This is confirmed by (Christie, 1985), who stated, "Mathematics education for blacks in South Africa has never been in a healthy state". (Graven, 2014) added that studies in South Africa tended to focus on the poorest (but largest) socio-economic status (SES) group since poverty affects more than half of the Education of our students. Teachers' perceptions of mathematics influence the way mathematics is taught in classrooms. (Khuzwayo, 2012) concludes that, in the 1970s, if any form of mathematics teaching/instruction was to be reformed, it had to conform to Fundamental Pedagogics (F.P.) philosophy. According to this philosophy, teachers were seen as authoritarian, and their function was to lead children to adulthood. (Spaull, 2011) added that Fundamental Pedagogics (F.P.) dictated how teachers were trained at teacher training institutions prior to 1994. (Khuzwayo, 2012) added that post-1994, the ideological mindsets of principals, teachers, and parents were not addressed effectively to meet the challenges of the previously disadvantaged schools. Mamphele Ramphele agrees with Spaull (Khuzwayo, 2012) by stating: "…We did not stop to take time at the beginning of the journey in 1994 to work on shifting our mindsets from those compliant subjects to those of dignified citizens." When students are constantly exposed to positive motivational messages about mathematics and its nature, their perceptions of mathematics and its role in life will improve (Dossey, 1992).

Vygotsky's socio-cultural theory in Education and (Howie, 2003) 's model of identifying factors related to mathematics achievement were used when analysing data retrieved from learners. Vygotsky's theory of concept development and (Kilpatrick et al., 2002) model of five strands of achieving mathematics proficiency were used to analyse data retrieved from teachers, departmental heads, and principals/deputy principals (Kozulin, 2003).

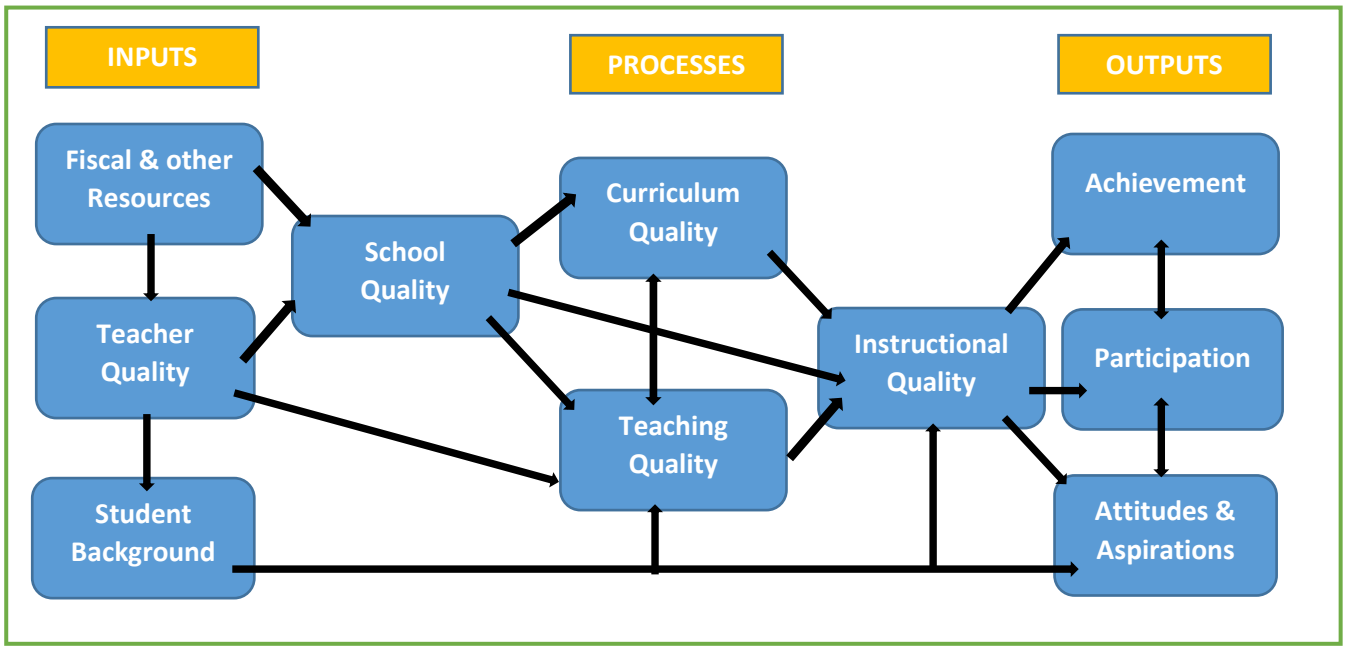


Figure 1. Factors related to mathematics achievement
Source: Howie (2000) adapted from Shavelson et al. (1987)

The model presented above, and participants' responses revealed shortfalls in the teaching and learning of mathematics within the circuit, which was used to recommend possible new strategies to improve learner mathematics achievement. The responses from participants of the school management teams (departmental head and deputy/principals) revealed what 'scaffolding' support was provided to teachers and learners of mathematics, and thus, further sustainable developmental support was recommended.

The responses to three questions in the questionnaire for learners, regarding 'family sources of income', 'home educational provisions viz. electricity, water, television, computer and internet accesses, and 'mode of travel to school,' were categorised to address the domain of 'Student background.' Teacher and instructional quality aspects were addressed by analysing and categorising responses from the mathematics teachers' questionnaires. These pertain to their professional and highest mathematics qualification, years of experience in teaching mathematics, and grades taught. These responses were correlated with responses from learners with regards to the following extract from the learners' questionnaire:

How does your mathematics teacher assist you with aspects of a topic you don't fully understand? You may choose more than one of the following.

| | | | | |
|---|---|---|---|---|
| Re-teaches topic | Additional Classes | Individual Attention | Refers you to another teacher | Does not assist you at all |

Explain how you would sketch the following graph without actually showing the solution to the following problem. Choose the chart for your grade.

| Grade | Equation of Graph |
|---|---|
| 8 | f(x) = 3x – 6 |
| 9 | f: 3x – 4y – 12 = 0 |
| 10 | f(x) = x2 – 9 |
| 11 | f(x) = x2 – 4x – 5 |
| 12 | f(x) = x3 – 4x2 – 11x + 30 |

The correlation was also assessed from the school mathematics performance records submitted to the education district office. Upon their visits, the researchers also observed the school's physical conditions in terms of physical infrastructure, water supply, electricity, learner attire, behaviour during breaks, availability of a feeding scheme, educational sporting facilities, and copying administrative resources. These observations addressed the domain of fiscal and other resources.

During their visits, the researchers observed the school's physical infrastructure, water supply, electricity, learner attire, behaviour during recess, the availability of a feeding scheme, educational sporting facilities, and copying and administrative resources. These observations were made to address the domain of financial and other resources.

**Research Methodology**

The population for this research consisted of all principals, deputy principals, departmental heads that supervise mathematics teaching and learning, all teachers of mathematics, and all grade 8 to 12 learners who offer mathematics in the seven high schools in the Phambela Circuit.

The researchers used intentional (purposive) sampling. Participation in management, supervision, teaching, and/or learning of Mathematics in high schools in the Phambela Circuit was the criteria for the chosen sample in this analysis. Seven principals or deputy principals, seven departmental heads who supervise Mathematics teaching and learning, fourteen Mathematics teachers (one Mathematics teacher who teaches in grades 8 and/or 9 and one Mathematics teacher who teaches in grades 10 to 12), and 35 learners (one learner from each grade from 8 to 12) from each of the seven high schools in the Phambela Circuit were included in the sample.

Table 1: Sample for this study (2019)
Source: Stanger Circuit Office

| Position | HS A | HS B | H.S. C | H.S. D | H.S. E | H.S. F | H.S. G | Total |
|---|---|---|---|---|---|---|---|---|
| Principal/Act / Dep. Principal | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Dept. Head | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Grade 8&9 Math Teachers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Grade 10,11&12 Maths Teachers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| No. of Gr 8&9 Maths Learners | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 14 |
| No. of Gr 10,11&12 Maths Learners | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 21 |

Learning mathematics with understanding is a complex process. Mixed-methods research is an appropriate response to calls for greater generalisation of results while maintaining sufficient detail on teaching and learning processes to be valid and valuable and make more significant contributions to research than a narrow study might make (Hart et al., 2009) (Dirkse van Schalkwyk & Steenkamp, 2020). Five of the seven high schools in the Phambela Circuit are deep rural schools, with the remaining two in a semi-rural area in the Phambela Circuit. The researchers opted to conduct interviews and questionnaires consecutively, as time, availability, traveling distance, and the alternate day school programme due to the COVID-9 pandemic posed challenges to the researchers in this study. The research questions guided the questions in the interview schedules and questionnaires. The researchers chose to adopt an adapted sequential transformative strategy. A combination of closed-ended and open-ended questionnaires, structured interviews, and a literature review were the critical methods used in this mixed-method study. The Department of Basic Education, KwaZulu-Natal, sought permission to conduct interviews and questionnaires. Identified schools, teachers, and learners of mathematics were notified prior to the researcher's visit. Consent from parents of learners under 18 years was sought. All participants were informed that their participation was voluntary and confidential. Visits to schools were held in April so as not to interfere with average instructional time. Interviews for teachers, departmental heads, and principals/deputy principals were held during their free periods or after school hours.

The focus was on the participants' context concerning the phenomenon to extract categories, themes, patterns, and symmetries from the data from interviews (Cohen et al., 2007). The researchers presented a qualitative analysis of data from the interviews and a quantitative analysis of the questionnaires through the phases illustrated in Table 2.

Table 2: Six Phases in the mixed-method data analysis process
Source: (Onwuegbuzie & Combs, 2011)

| Phase in the Mixed methods analysis of data process | Application in qualitative data analysis using Atlas.ti | Application in the quantitative data analysis using SPSS |
|---|---|---|
| Phase 1<br>(Data Reduction, capture, coding, and display) | 1(a) Qualitative data reduction, data capture, coding, charts, and diagrams | 1(b) Data capture, data Display (descriptive stats, tables, and graphs) |
| Phase 2<br>(Data transformation) | 2(a) Qualitative data is represented statistically | 2(b) Quantitative data is translated into narrative data that can be analyzed qualitatively |
| Phase 3<br>(Correlation of Data) | Correlation between qualitative and quantitative data | |
| Phase 4<br>(Consolidation of Data) | Qualitative and quantitative data are combined. | |
| Phase 5<br>(Comparison of Data) | Qualitative and quantitative data are compared | |
| Phase 6<br>(Integration of Data) | Qualitative and quantitative data are integrated into a coherent whole (Final findings and discussions) | |

Because of the poor transcription quality using trial versions of audio-to-text applications like Amberscript, Happy Scribe, TranscriberPro, and other online audio-to-text, the researchers decided to listen to each audio interview and reduce each interview to a tabular form for each category of participants. This gave the researcher the chance to clean up the data. Data from each interview question was dealt with separately for each participant during data reduction (describing, summarising, and interpreting, to present a more precise picture (Murray, N., & Berglar, 2009).

Although the researchers identified 63 participants, 57 interviews, and questionnaires were completed in this study. Two schools did not have a Department Head (D.H.), the D.H. of a third school was on sick leave, two teachers were attending a workshop, and one learner was absent during the visits. The 57 interviews were examined and analysed. The researcher used codes to represent what was happening in each response rather than the raw reduced data from interviews. Codes are one- or two-word concepts that clearly and succinctly describe what's going on in the data (Chametzky, 2016).

The researchers made use of the qualitative analysis application, ATLAS.ti version 8. Each data reduction of interviews was uploaded, and codes were assigned to pieces of responses (quotations) from each participant. All the data reduction of interviews for principals/deputies, teachers of Mathematics, and learners, one from grades 8 to 12 was coded, and these codes were examined to see if they could be meaningfully grouped together (Smith et al., 1999). The codes were compared and analysed to search for patterns in the data (Saldhana, 2009). Codes with similar themes were organised into Code Groups. The code group was thereafter illustrated as a Network. A network is a Code group with its codes that were expanded to give individual original quotations associated with the data-reduced document.

45.2 % (n=57) of the codes created to represent the quotations from the interviews comprised Learner Attitude and Behaviour, Unawareness of the effect of Annual Teaching Plans (ATP) and School Based Assessment (SBA) on Mathematics learning, Shortage of Learner Support Materials (LTSM) and Language Barrier. Learner Support Materials, Non-Mathematics inclined Departmental Head, Unaware of the Teaching Mathematics for Understanding Framework, and Staffing problems are the significant challenges to supervision and monitoring mathematics.

Learner behaviour poses the most significant challenge to improving mathematics performance. Learners also cite teacher attitude as a problem. Although most learners indicated that they are satisfied with teacher lesson presentations, the lack of procedural fluency initiated by mathematics teachers is emphasized. Most teachers suggest that the poor mathematics background and the language barrier of learners contribute to their absconding from mathematics classes. Class sizes in the GET phase increase the misbehavior of those uninterested in passing mathematics.

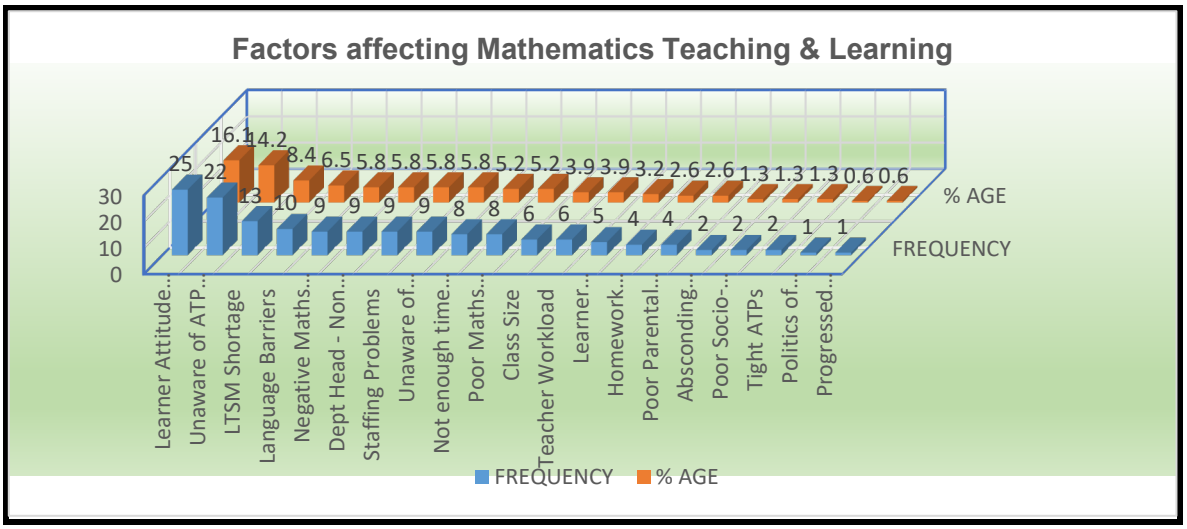


Figure 2: Factors affecting Mathematics Teaching & Learning

The researchers made use of the SPSS Data Editor. Variables for each question were created and value-coded all options to the questions for each questionnaire, as quantitative analysis is associated with numbers.

The researchers proceeded to analyse the different questionnaire categories - Principals/Deputy principals, Departmental Heads, Teachers of Mathematics, and Learners of Mathematics. Statistics of various variables in all categories of the questionnaires and a descriptive frequency statistic of all variables relating to the research questions were presented. These frequency statistics were converted into narrative data that could be qualitatively analysed.

Figure 5 reveals that 63.6% (n=11) of the School Management Teams (Principal, Deputy, and Departmental Heads) experience moderate to many challenges in supervising and monitoring Mathematics teaching and learning within the high schools in the Phambela Circuit.

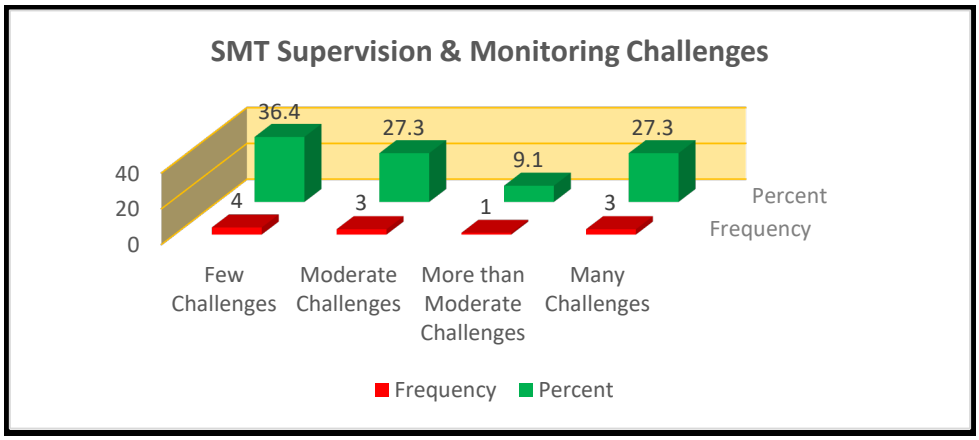


Figure 3: SMT Supervision and Monitoring Challenge

Figure 6 reveals that 66% of parents provide little or no support for teachers of Mathematics in the Phambela Circuit.

Figure 7 indicates that 57% (n=34) of learners come from families whose income consists of social grants, state pensions, and caregiver sponsors.

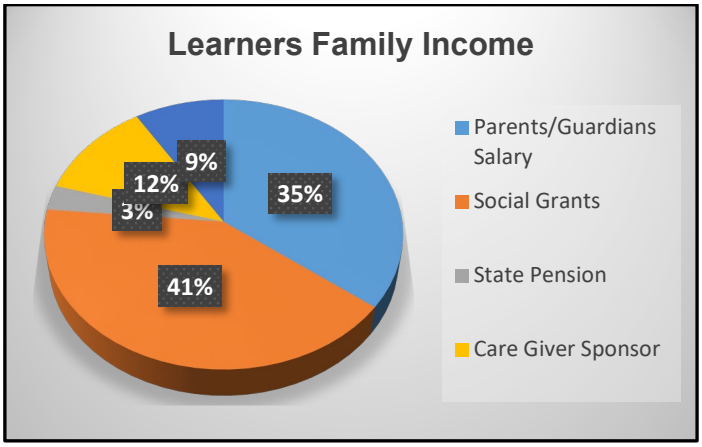


Figure 4: Learner's Family Income

Nine themes emerged through the correlation of data discussed earlier, and a further eleven themes through the consolidation of interview and questionnaire data. Learners were generally satisfied with how their teachers presented lessons, which does not correlate with the response of teachers with regard to their behaviour and attitude in mathematics classes. Math classes are also being skipped, according to SMT members. "During Math class, students are not in the classroom. They despise math." "They are struggling in Maths, evident in the GET Maths results," one principal said.

There exists a strong negative correlation between Access to Amenities and Procedural Fluency in Mathematics. In other words, the lack of adequate access to amenities like water, electricity, internet, television, radio, cell phones, and computers often will Mathematics procedural fluency not to exist. With Interview data, this type of correlation was not possible.

(Cresswell, 2014) and (Bryman, 2006) agree that the research questions drive the selection of the research methods. Bryman adds, "One of the chief manifestations of the pragmatic approach to the matter of mixing quantitative and qualitative research, is the significance frequently given to the research question." The researchers provide the following table (see Table 3) to illustrate how data integration from both methods was presented.

Table 3: Integration of interview data with questionnaire data

| Overall Themes | Sub-themes | Themes Identified |
|---|---|---|
| Challenges that affect Mathematics teaching & learning in high schools in the Phambela | External Barriers | Non-Maths inclined SMT<br>Parental Involvement & Cooperation<br>Socio-economic status of learner families<br>Poor Mathematics background<br>Language Barrier<br>Learner negative Mathematics perception<br>LTSM shortage<br>Class sizes<br>Staffing problem. |
| | Internal Barriers | Impact of ATPs and SBAs on Mathematics teaching and learning. |

| | | |
|---|---|---|
| Circuit | | Awareness of the Teaching Mathematics for Understanding Framework<br>Learner behaviour in the mathematics classroom<br>Tight ATPs. |

## Results and Discussion

The researchers revisited the external and internal challenges and re-classified them into three categories of challenges that impact the teaching and learning of Mathematics in high schools in the Phambela Circuit. These challenges were categorised into systemic, societal, and pedagogical challenges to answer the research question: What challenges within the circuit do teachers and learners of Mathematics experience?

## Systemic Challenges

In post-apartheid South Africa, class sizes and staffing in public schools were inherently problematic. While learner-to-teacher ratios were low in ex-model C and private schools, most public schools are overcrowded. Despite the Department of Basic Education's post-provisioning requirements and standards for school staffing and funding, policies to resolve equity and redress issues (overcrowded and poor schools), most public schools in the Phambela Circuit remain overcrowded. The learner-teacher ratio for mathematics in the high schools in the Phambela Circuit in 2019 was 71:1. This indicates the model for post-provisioning for the school of the KwaZulu Natal Department of Basic Education was not working.

Mathematics ATPs were time-constrained and could not be completed in the allotted time, and teachers of Mathematics were forced to use extra classes to complete the ATPs. The mathematics teacher was not given the freedom to tailor the ATPs to her students' abilities and the unique challenges that her school faced. This is demonstrated by the topics tested in Grades 10, 11, and 12, common provincial tests, and National Mathematics papers. The COVID-19 lockdown demonstrated that ATPs could be tweaked to meet the needs of different schools.

81.8 percent (n=11) of school management teams in the Phambela Circuit in charge of mathematics teaching and learning lack a mathematical qualification or experience. The lack of a mathematical background does not motivate for learners to improve their mathematics skills. Departmental Heads must make a meaningful contribution and play a supportive role in content creation, interaction, and discussions, encourage teamwork and provide alternative solutions to problems to improve learner mathematics performance.

The promotion and progression requirements for the GET phase are vastly different from those for the FET phase. In the GET phase, there is an annual adjustment to the promotion requirements. Learners in the GET phase who met all other requirements but failed mathematics in 2019 were permitted to advance to the next grade. This allowed students (and, in some cases, teachers) to avoid working harder in mathematics during the GET phase because they were assured of progression to the next grade, even if they failed. Learners' negative attitudes toward mathematics were carried over into Grades 10 and 11, where they were permitted to fall mathematics while passing all other subjects and still receive an overall pass.

Teachers and learners are not actively engaged in investigative work due to a lack of mathematical instruments such as calculators, compasses, dividers, protractors, rulers, and set squares. The non-return of LTSM by students, exceptionally loaned textbooks and calculators, creates a problem for the following year's recipients.

**Societal Challenges**

50 percent of learners interviewed come from low-income families who rely on state pensions, social grants, or caregiver sponsorship. The cost of additional reference books, guides, and stationery such as scientific calculators and mathematics instruments such as compasses, dividers, and set squares posed a challenge to students from these backgrounds.

There are serious language barriers that learners face. This makes it challenging to translate definitions of mathematical concepts. Most of the students speak isiZulu as their first language. Furthermore, because they are not fluent English speakers, there is an element of embarrassment for learners to participate in group/class discussions. The wording and phrasing of questions on common tests and examinations differ from those used in daily classwork and homework assignments. Most students have an innate dislike for mathematics that they develop at a young age. Parentals, peers, and teachers exacerbate this comments that mathematics is difficult. When it comes to their children's mathematics performance, teachers receive little or no cooperation from parents. Only a few interested parents of students with a positive attitude toward mathematics attend open days.

**Pedagogical Challenges**

Mathematics teachers in the Phambela Circuit cannot complete the grade ATPs because they spend extra time re-teaching basic mathematical fundamentals such as addition, subtraction, multiplication, and division. Mathematics is taught in watertight compartments, and they believe that what was taught in previous grades is no longer relevant in the following grades. The most difficult challenge for teachers and interested students in the mathematics classroom is poor learner behaviour. Only a few students in the class are engaged in the lesson, while the majority are obnoxious and disrupt lessons.

The ATPs and SBAs are unknown to two-thirds of students. These documents define the scope, provide direction, and outline a strategy for completing the year's syllabus. They provide crucial information about the weighting (in terms of marks) for each section of mathematics, which impacts the number of time students and teachers must devote to that section. The Framework for Teaching Mathematics for Understanding was unknown to 50% of the SMT and Mathematics teachers. This framework uses a conceptual field approach, which allows students to see mathematics as a connected network of concepts, relationships, and connections between the various ideas and processes.

The goal is to raise teacher awareness and teaching skills. Teachers cannot present mathematics lessons to modern children from various backgrounds and face multiple social challenges, despite having the necessary content knowledge. The lesson presentation's didactics must be revised regularly to keep up with the current classroom situation, and lessons that have worked in the past may not work in the present or in the future. The teacher's bag of pedagogic techniques has been revamped to meet modern trends in mathematics teaching and learning. Although the mathematics teachers at Phambela High School are well-qualified, they lack various teaching strategies. Many students expressed dissatisfaction with their ability to complete classwork and homework without the teacher's assistance. During the COVID-19 pandemic, this lack of alternatives to the "chalk and talk" technique became apparent. Teachers were tasked with communicating with students and assigning tasks via social media such as WhatsApp chat groups, text and voice notes, Google Classroom, and other electronic media due to school closures. Most teachers were not trained or workshopped in using internet-based learning, the Department of Education, and most were not adequately prepared to adapt to this situation.

## Recommendations and Conclusion

### Systemic Challenges

The KwaZulu Natal Department of Basic Education oversees developing class sizes and school staffing policies. On the other hand, the principal, the SGB, and the school management teams can all play an important role in this process. When the Post Provisional Staffing Norms are released, school management teams and SGBs must admit new students based on available space and staff. Principals, SMTs, and SGBs, must proactively plan for new student enrolment in the coming year. Principals must not over-enroll new students to benefit from principal promotion and the creation of unique promotional positions within the school. Overcrowding will be the result, which will have a negative impact on mathematics teaching and learning.

Teachers complain that the ATPs in mathematics are too tight and that there isn't enough time to finish all the topics, especially given the challenges they and their students face in the Phambela Circuit. To begin, the researcher suggests that mathematics teachers gather in schools and a professional learning community to examine the mathematics ATPs, share ideas, challenges, and propose timeframes for ATP topic completion and School Based Assessments related to the mathematics topics indicated in the ATPs. The results of these discussions should be forwarded to the Teaching and Learning Community (TLC). Secondly, the researcher recommends that the mathematics ATPs in grades 8 to 12 be revisited, with the intention of combining topics to form modules that relate to the mathematics modules offered in higher institutions of learning. The choice of answering a compulsory module and a minimum of other modules be given to learners. (Khuzwayo, 2012) indicated that while other subjects were challenged and changed, mathematics remained intact. The concept of module selection allows the learner to select modules relevant to the future career she wishes to pursue. Mathematics modules must be relevant to the job market and valuable in the learner's professional life. Mathematical performance among students has reached an all-time low. In the Phambela Circuit, an increase in learner performance in mathematics was associated with an increase in the overall pass rate of high schools in the Grade 12 National Senior Certificate Examinations.

If we are to improve learner mathematics performance, the SMT's constructive role in managing the teaching and learning of mathematics is critical. According to the findings, over 81 % of SMT in Phambela high schools who supervised and managed mathematics had no background in the subject. The researchers recommend a one-year post-matric qualification in mathematics as a criterion for a Departmental Head appointment and regularly workshopped on the effective management of mathematics teaching and learning. It has been observed that the pass mark for mathematics in the GET phase is relaxed every year, and members make this decision of the Executive Council of Provinces before the schools' final examination. In 2019, if a learner in the GET phase passed all subjects but failed mathematics (by any percentage), that learner was given a condoned pass in mathematics to help them progress to the next grade.

This trend of changing the mathematics pass requirements in the GET phase appears to provide an incentive for GET mathematics learners to reduce their focus on mathematics. The GET Phase lays the groundwork for basic skills in high school mathematics. If the teaching of mathematics skills is compromised during this phase, students' performance in the FET phase will suffer. These measures by the Department of Basic Education prompted (Jansen, 2017) to observe that rather than solving the problem at the input side of the education equation (creating competent mathematics teachers and learners), the Department of Education wrecks the lives of learners by lowering the standard at the output side (lowering the mathematics achievement standard), and as a result, the Department of Education channels the lives of learners to dead-end careers. According to the researcher, the emphasis should be on the 'input' side of the Education equation. As early as grade one, poor learner mathematics performance must be identified and continuously

remedied by a special mathematics program. The researchers suggest using the "Teaching Mathematics across the Curriculum" strategy.

The procurement committee of the school and parents are responsible for providing learner mathematics LTSM. The state subsidizes the purchase of LTSM in public schools (textbooks and stationery). Furthermore, there is a state subsidy for other LTSMs. Schools must prioritize mathematics LTSM, such as non-programmable scientific calculators and mathematics manipulatives.

**Societal Challenges**

Over half of the students in the Phambela Circuit's high schools are from the lowest socio-economic group, relying on social grants and state pensions from parents and/or caregivers. While the researchers cannot make specific recommendations for improving the economic status of learners' families, they suggest that the school develop innovative ways to reduce the impact of low-income families on students' academic performance. This recommendation supports (Spaull, 2011) claim that school/SES has a more significant effect on learner performance than individual/SES. According to (Spaull, 2011), the negative educational effects of a child from a low-income family can be mitigated by enrolling the child in a well-resourced school. Of importance is that the Circuit/District office monitor that the state funding allocated to benefit the child is channeled correctly and accounted for.

Even though most Phambela high school students speak IsiZulu as their first language, English is used as LOLT to teach all subjects except IsiZulu. Code-switching from English to IsiZulu and vice versa for teachers who can communicate in both languages is recommended. While the researchers recognize the importance of the mother tongue, the researchers also acknowledge the importance of having English as a second language of communication for global commercial purposes. Except for Afrikaans, South Africa and its nine provinces have not yet reached the point where non-mother tongue subjects can be taught in the province's mother tongue. There is still much work to be done in translating textbooks or creating new teaching materials in the local language. However, the researchers acknowledge that this is possible because Afrikaans was used to teach all subjects to the Afrikaans-speaking community during apartheid and in some schools in South Africa today. Mathematics can be prepared in any language or combination of languages if there are sufficient physical and human resources to engage in language teaching and learning.

According to this study, most high school students in the Phambela Circuit have an innate dislike for mathematics. This perception can't be attributed to a single factor. This research found that it could be a combination of language barriers (communication) issues, anxiety, learner/teacher absenteeism, absconding from critical mathematics lessons, and large class sizes with no individual attention. This is exacerbated by the negative attitude toward mathematics parents and peers convey to students in the early stages of schooling.

According to this study, teachers receive little or no cooperation from parents regarding their children's mathematics performance. While parental involvement significantly impacts their children's Education, several barriers prevent parents from participating in school programs. Before passing judgment on parents' non-participation, the researchers suggest that the school (principal and staff) acknowledge the barriers to parental involvement in school activities.

**Pedagogical Challenges**

According to this study, teachers of Mathematics in the Phambela Circuit cannot complete the respective grade ATPs because they spend extra time re-teaching fundamental mathematical concepts taught in previous grades. Mathematics teachers should view students with weak mathematical fundamentals as having different

zones of proximal development, and teachers must investigate other scaffolding options to get these students to do the work independently.

According to this study, poor learner behaviour poses the most significant challenge to teachers and interested students, in the mathematics classroom. To begin, the mathematics teacher must determine what is causing the students' poor behaviour. The following issues were discovered in this study: large class sizes, a lack of mathematics background, a negative attitude toward mathematics, peer pressure, insufficient LTSM, and the language barrier. Mathematics teachers concluded that disruptive behaviour directs learners to abstain from learning mathematics and abscond lessons. The researchers recommend collaborative and cooperative learning in small groups and implementing the 'accumulation of credits in exchange for rewards.'

This study revealed that two-thirds of learners interviewed were unaware of the ATPs and the SBAs documents, which consists of topics in mathematics for the year, the time frame to complete the issues, and the school-based assessments (with dates) that will be implemented for the year. These documents are condensed and distributed at the beginning of each academic year to all parents/learners.

The Teaching Mathematics for Understanding document outlines a paradigm shift in how mathematics is taught in schools. The document promotes a conceptual approach to teaching mathematics. The researchers suggest that this document be updated to include more exemplars to assist mathematics teachers in implementing conceptual approach lessons in their classrooms. The document should go over various topics in mathematics, with examples showing how conceptual understanding, procedural fluency, strategic competence, and reasoning are interrelated and impact the learning-centered classroom.

According to this study, Mathematics teachers used old teaching methods and strategies in delivering lessons. In today's classrooms, there was a lack of lesson planning that was adapted to the learners' challenges. Today's mathematics teaching methods are not based on the "stand and deliver," "chalk and talk," or "one size fit all" mindsets. It's about getting to know the students in a class, their emotional and behavioural disorders, anxieties, and social challenges that they bring to mathematics class. There is a need for collaboration and communication between mathematics researchers and teachers of mathematics (Ramanujam, R., Sachdev, P. L., Subramanian, R., Bhattacharyya, A., Mukherjee, A., & Kumari, 2006) on how to adapt teaching to the modern learners with different learning styles. The researchers recommend forming high schools and higher institutions of learning, Mathematics Professional Learning Communities to explore innovative ways of adapting teaching styles for the modern learner.

Learners complained in this study that they struggled to complete classwork or homework without the teacher's help. They claim that current teaching styles and strategies in the inclusive classroom do not cater to all students. The 'Rotation Method' is another alternative teaching strategy. The rotation method involves the teacher moving with the class from one grade level to the next, such as from grade 10 to 12 or from grade 9 to 12, depending on the school's needs. This method allows the teacher to identify students who have barriers to learning and their preferred learning style. The teacher will also be familiar with the student's prior knowledge.

The researchers also recommend a 'Blended Teaching/Learning Strategy. When a teacher provides instruction in both traditional "face-to-face" classroom interaction and computer-assisted online learning, this is known as blended teaching/learning. South Africa was under COVID-19 lockdown at the time of writing this chapter. Due to teacher comorbidities, some teachers chose to work from home. Teachers with technical knowledge of how to use the internet, e-mail, and social networking chat groups like WhatsApp, Facebook, Instagram, and Twitter to engage students in lessons found using these electronic media very useful. The researchers recommend that CAPS Blended teaching and learning be promoted and funded by the Department of Education to improve learners' academic performance in mathematics.

## Conclusion

This study also suggests that, regardless of how many barriers exist in a learning situation, the principal and their staff can use alternative teaching strategies, techniques, and methods to minimize or eliminate them, focusing on the child's best interests. The importance of the school-community relationship cannot be overstated. All sciences and technology, and thus all human progress, are built on the foundation of mathematics. As a result, mathematics teachers must be able to instruct students effectively and efficiently. They must tailor their lessons to their student's needs and learning styles. They must acquire the necessary skills and keep up with the most up-to-date teaching and learning techniques in mathematics. They need to develop technologically to meet the demands of the Fourth Industrial Revolution (4IR). Teachers must recognize that technological advancements have elevated learning and teaching to new heights. Technology has brought the world into the classroom and taken the classroom into the world, and Education and learning can occur anytime and anywhere. When planning e-learning activities, teachers must consider the future when the students they teach will use technologies far beyond what is currently available.

Outside school, policymakers must come on board and provide the necessary training before acquiring the relevant technological hardware and software to develop adaptable and technologically competent mathematics teachers and learners. Teachers must understand that no amount of new technology will ever be able to compensate for a poor mathematics teacher. As a result, to prepare teaching materials and assessments that go along with software-based e-learning, the mathematics teacher must refer to theories of learning and teaching (Vygotsky's socio-cultural and conceptual development, ZPD, and Mathematics procedural fluency through scaffolding in all its forms). We must refocus our priorities and resources to implement this study's recommendations and strategies because passing high school mathematics opens the door for our children to be accepted into tertiary institutions of higher learning, resulting in better career opportunities.

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