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Why Do Learners with Limited Resources Use or Not Use Technology in Mathematics Learning?

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Abstract. Current statistics show that the number of grades 10 – 12 mathematics learners in South African schools is still very low compared to learners in general curriculum subjects. Furthermore, these learners do not perform well on the grade 12 mathematics tests. Technologies are seen as tools that attract learners to mathematics and positively influence mathematics teaching and learning. This mixed methods study was conducted against this background, in consideration of the need for ongoing research on learners' use or non-use of educational technology in mathematics in socio-economically disadvantaged South African schools. This study investigated two socio-economically disadvantaged schools in South Africa and, included 79 learners between grades 10-12 who filled out a questionnaire. Two focus group interviews were also conducted. Key findings are that the learners' use of educational technology in the two schools is consistent with the teachers' use of such technology. The most used technologies are the calculators and the smartphones. In conclusion, I argue that teachers' appropriate use of calculators and smartphones in teaching mathematics positively influences learners' use of calculators and smartphones. It is, therefore, recommended that the use of calculators and smartphones in mathematics teaching be encouraged in the context of socio-economically disadvantaged schools.

Keywords: educational/learning technology; mathematics learning; socio-economically disadvantaged schools

1. Introduction

Today's learners are exposed to various technological devices both at schools and outside the school environment. The potential for technology to create opportunities for enhanced mathematics education has been widely recognised (Fabian et al., 2018; Reinhold et al., 2020). Both the public and the private sectors are making every effort to equip schools with technological resources, on the assumption that the learners at these schools will have developed technological skills as a result of this exposure (Beckman et al., 2014; Corrin et al., 2010).

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However, some authors challenge this assumption, asserting that exposure to technology does not necessarily result in the acquisition of skills (Selwyn, 2008). Intentional use and proper planning can contribute to the development of learners' technological skills (Naik et al., 2020)

Consideration has been given in the past to (among other focus areas) the improvement of mathematics education in South Africa through the integration of technology in the classroom (Department of Basic Education, 2015). Findings in this field vary. There is no simple agreement among researchers on whether ICT use, positively or negatively affects academic achievement, owing to the heterogeneous nature of such effects (Falck et al, 2018; Fernandez-Gutierrez et al., 2020). A quasi-experimental study conducted in South Africa by Adelabu et al., (2019) using GeoGebra to teach similarity and congruency of triangles, found that the learners who were taught with the use of GeoGebra performed better than the learners who were taught without GeoGebra. The teacher taught the control group while the researcher taught the experimental group. No explanation was given for the arrangement. The assumption is that the teacher might not have been skilled in using the GeoGebra software for teaching. The control group had 50 learners while the experimental group had 37 learners. The larger number of learners in the control group had implications for the teacher regarding giving the learners individual attention when needed. The accepted teacher-learner ratio in South African schools is 1:35 (Department of Basic Education, 2019). Also, the lower number of learners in the experimental group could be due to the availability of computers in the school.

Also, Saal et al. (2020) used the 2015 grade 5 Trends in International Mathematics and Science Study (TIMMS) data set of South Africa to investigate the relationship between the use of educational technology in teaching and learning and learners' performance in mathematics. Saal et al. (2020) found that learners who used computers every day, or almost every day at home, school and other places for schoolwork achieved lower results than learners who used the computers every day or almost every day at school. They concluded that this could be a result of incompatible educational software found in different places. This is consistent with Selwyn (2008). Thus, it remains important to conduct ongoing research, that focuses on the reasons that influence learners to use or not use technologies in mathematics learning, especially in socio-economically disadvantaged communities where access to technological resources remains a major challenge. Understanding factors affecting underprivileged learners' use of technology in mathematics can assist in developing strategies to deal with obstacles experienced by these learners. This research has the potential to provide insights into the complexities of learners' experiences with technology for mathematics learning to improve the use of technology in the learning environment.

There are several different technological tools that learners can use in mathematics. Smartphones and tablets enable collaboration among learners in a mathematics learning environment (Fabian et al., 2018). A collaborative learning environment helps learners improve their mathematical thinking, problem-tackling, reasoning, representing, and communication competencies (Niss &

Jensen, 2002). Software programs like Dynamic Geometry Computer Software (DGCS) also provide settings in which learners can construct and experiment with geometrical objects and relationships (Sinclair & Robutti, 2012). This helps learners discover mathematical ideas and understand mathematics at a deeper level (Adelabu et al., 2019; Sawaya & Putnam, 2015). The South African government developed the e-Education policy (Department of Education, 2004) and the Guideline for Teacher Training and Professional Development in ICT and Training (Department of Education, 2007). These documents opened ways for initiatives to enhance the use of technology in teaching and learning (Isaacs, 2007). The initiatives focused on teacher professional development, providing different technological tools and developing content that can be used in teaching and learning. Despite these initiatives, current studies in South African schools still report that socio-economically disadvantaged schools do not have the necessary educational technology tools; for example, Mokotjo and Mokhele (2021) found that one of the challenges of integrating GeoGebra in mathematics was insufficient resources in a socio-economically disadvantaged school. Provinces like Limpopo and the Eastern Cape have more than 80% of schools without computer centres (Department of Basic Education, 2019). On the other hand, a province like Gauteng has less than 20% of schools without computer centres (Department of Basic Education, 2019). This implies that many learners from Limpopo and the Eastern Cape provinces will face more challenges than learners from Gauteng province. It is on this basis that the study was conducted. The following research study guided the study.

- How do learners with limited resources use technology in mathematics learning?
- Which internal and external factors affect learners’ use of technology in mathematics learning?

2. Literature Review

Several factors may influence learners’ use of technology. For this study, various literature sources were reviewed to explore learners’ use of technology in their everyday lives and mathematics learning.

2.1 Learners’ Use of Technology in Their Everyday Lives

Learners use technology in their everyday lives for different purposes and in different settings. Learners can communicate using technologies like smartphones, tablets and iPads. Corrin et al. (2010) found that learners had high levels of access to mobile phones, desktop computers and laptop computers. Learners used these tools mostly for social networks and communication-based activities (Corrin et al., 2010). However, Corrin et al. (2010) did not focus on the environment in which the learners used the technology. Their study was also conducted in a higher education institution. In a study focusing on secondary school learners; Beckman et al. (2014) found that learners’ use of technology was dominated by communication activities. Beckman et al. (2014) further indicated that the environment in which the learners used the technology contributed to how learners used the technology. The school environment placed more restrictions on learners’ use of technology than the home environment

(Beckman et al., 2014). Furthermore, the studies mentioned above were conducted in a developed context wherein access to technology is not a problem.

In a developing context like South Africa, access to technology is still a problem (Isaacs, 2007; Munje & Jita, 2020; Mwapele et al., 2019). This is due to poor or no technological infrastructure in socio-economically disadvantaged communities. Technological infrastructure influences the use of technology in teaching and learning (Basak & Govender, 2015; Mulwa & Kyalo, 2011). A study conducted by Baako and Abroampa (2024) in the slum public schools area of Ghana, found that learners' limited access to technological resources for learning at school and home, poor support from parents on the use of technology for learning, and unreliable or inadequate access to the internet at home and school contributed to learners' low level of use of technology for learning. Baako and Abroampa (2024) recommend collaborative initiatives between parents and teachers to create a cohesive support system that will enhance learners' use of technology for learning. In South Africa, Brown and Czerniewicz (2010) analysed how two students - one from a socio-economically advantaged background and the other from a socio-economically disadvantaged background - acquired their technological skills and used them in their daily lives and to navigate their studies. Although the two students developed a habit of using technology, their different socio-economic backgrounds shaped the choices they made in terms of how the technology was used. This demonstrated that socio-economic background plays a role in the use of technology for learning. Another study by Adukaite et al. (2016) found that South African under-resourced schools used technology in a limited manner due to limited resources. On the other hand, resourced schools used technology regularly for curriculum delivery, connecting with colleagues and sharing materials

None of the above-mentioned studies focused on a specific subject. Different technological tools provide different opportunities depending on the subject. For example, the affordance of a smartphone for geography is different from that for mathematics. There is a dearth of studies on learners' uses of technology in mathematics in South African socio-economically disadvantaged schools' contexts. Understanding learners' use of technology in mathematics in this context will enable teachers and education directors to provide the best conditions to maximise the potential of using technology for learning.

2.2 Learners' Use of Technology in Mathematics Learning

Schools in South Africa are culturally and socio-economically diverse. In overcrowded classes, it is difficult for mathematics teachers to engage with all the learners in a single period. However, gadgets like mobile devices can assist teachers in reaching all learners beyond the classroom environment. Fabian et al. (2018) found that effective use of mobile devices depends on activities designed by the teachers, the absence of technical breakdowns and learners' characteristics. This points to the importance of the teacher's role in ensuring that learners use technology effectively in mathematics learning.

In Ghana, Agyemang et al. (2019) found that the frequency of senior high school learners' use of technology in mathematics was very low. This was due to schools' regulations, which gave learners access to the computer laboratory only once per week and did not permit learners to use the computer laboratory after school or during weekends. This does not permit learners to have enough hands-on experience in using mathematics software in the school. Learners are likely to be demotivated due to a lack of skills in using computer software (Mokotjo & Mokhele, 2021). The study also found that learners' low level of technology usage was consistent with teachers' use of technology. The findings call for school governing bodies to consider policies designed for their schools and to come up with strategies to fundraise to acquire more technological resources. Namome and Moodley (2021) used the 2015 TIMMS results to examine the relationship between frequent use of and access to technology in school and home settings and achievement in mathematics for grades 8 and 9 in four African countries, namely Botswana, Egypt, Morrocco and South Africa. Their findings revealed that learners' access to instructional computers during the lesson was a significant positive predictor of mathematics achievement. This implied that, if teachers used the computers together with the learners during the lesson the learners' achievement in mathematics could be improved. However, Namome and Moodley (2021) further indicate that the effectiveness and efficiency of technology usage in the classroom are negatively affected by a shortage of technological resources for all learners and inadequate technical support and competency in using technology in the classroom. Challenges of this kind are typically faced by African countries. It was on this basis that I investigated factors that promote or impede the use of technology by learners in mathematics learning.

3. Research methodology

The study used a mixed methods approach to gain a deeper understanding of factors influencing learners' use of technology in mathematics. A mixed methods research approach is one in which the researcher uses both quantitative and qualitative approaches in a study (Creswell, 2014). Qualitative and quantitative data were collected simultaneously, meaning that a parallel mixed methods approach was used. The two data sets were integrated in the discussion section. This assisted in improving the interpretation of results as the data was triangulated. Thus, I got a thorough understanding of how learners make meaning out of their experiences.

3.1 Quantitative Approach

This research approach involves a numerical or statistical approach to research design. Data is used objectively to measure reality (Creswell, 2014). I used objective questionnaires to create meaning, soliciting information on factors affecting learners' use of technology in mathematics learning. Statistical information simplified into percentages made communication easier and brought reality home to the reader. The statistical information was used at the data analysis stage of this study. Thus, a descriptive data analysis process was followed (Creswell, 2014).

3.2 Qualitative Approach
This is described as an unfolding model that occurs in a natural setting and enables the researcher to develop a level of detail from close involvement in the experience (Cohen et al., 2017). One identifier of qualitative research is the social phenomenon being investigated from the participants' viewpoint (Cohen et al, 2017). In this study, 14 learners out of 79 were involved in a focus group discussion.

3.3 Research Population and Sampling
Two socio-economically disadvantaged schools were purposefully selected in Limpopo province of South Africa. The schools are referred to as School A and School B. The schools were selected because they were using educational technologies in their mathematics teaching and learning and were in a socio-economically disadvantaged community. Permission for participants younger than 18 years was sought from their parents. All the participants gave their consent to participate in the study. Participants were informed of their voluntary participation in the study, and that their names and identities will be kept confidential. Thus, all the names used in this study are pseudonyms.

I had intended to have 60 sampled learners in grades 10-12 for each school participating in the study; however, I ended up with 79 learners: 43 from school A and 36 from school B. Grade 10-12 learners were chosen because the South African government pays more attention to these grades as the learners are exiting the Department of Basic Education to the Department of Higher Education and Training. There is pressure on the South African government to increase the number of learners exiting basic education with a good grade 12 mathematics pass. Thus, all the strategies that may help mathematics learners to exit with a good pass are important. A further sampling based on learners' technology usage was conducted for the qualitative part of the study. Learners who indicated that they use more than two technological tools and how they used the tools for mathematics learning were purposefully selected to participate in the focus group interview. This was one of the questions in the quantitative part. One focus group interview was conducted at each school. Each focus group interview had seven participants.

3.4 Data Collection Methods
A focus group discussion and a questionnaire were used to collect data from participants. Two data collection tools ensured a more complete description of factors affecting learners' use of technology in under-resourced schools. The interview questions were divided into four sections. The first section sought to get information on learners' access to technological tools and the support they get from the school. The second section focused on learners' skills in the use of educational technology. In the third section questions were related to learners' persistence in and attitudes towards the use of educational technology in mathematics. The last section sought to obtain information about learners' perceptions of the value of the use of educational technology in learning.

The questionnaire attached as Appendix 1 consisted of three sections which were: participants' demographic information; their use of technology use; and their attitudes towards mathematics and the use of technologies in mathematics. In the demographic information section, participants were requested to indicate their age, grade, school, and gender. The section on technology use had three parts. In the first part, participants were given a list of different technologies and asked to use a tick to indicate the technologies that they owned. In the second part, they were asked to list the technologies they used for mathematics learning and how they used them. The last part was subdivided into two parts. In the first subdivision, participants were given statements and had to indicate how frequently they used technologies to perform specified activities at school. The scale for frequency of use of technologies ranged between *Never, Yearly, Monthly, Weekly* and *Daily,* which indicated a low frequency of use to a high frequency of use. In the second subdivision, participants were given statements and had to indicate how frequently they used technologies to perform specified activities at home. The scale was the same as the first subdivision. This part focused on learners' skills in the use of technology generally and in mathematics learning specifically. The last section focused on learners' attitudes towards the use of technologies in mathematics learning. This section consisted of statements that were ranked on a Likert scale. The statement focused on learners' confidence, skills in their use of technology learning, and the benefits of the use of technology in mathematics learning. All the mentioned variables in the focus group interview and the questionnaire, are indicated in the reviewed literature as contributing factors to the effective use of technology in mathematics teaching and learning.

3.5 Reliability and Validity

To ensure the quality of the research, I used several strategies throughout the process. A pre-test study was conducted with 30 learner participants who were not part of the study. Also, the Cronbach's Alpha score for all Likert-type questions was greater than 7.0. To ensure credibility three forms of triangulation were used. The forms are methodological, space and data triangulation. The questionnaire and interviews were conducted to cater for methodological triangulation, two schools in different communities catered for space triangulation and using the same data collecting method on different participants catered for data triangulation.

3.6 Data Analysis

Data collected from the interviews was analysed using qualitative analysis, while data gathered from the questionnaire was analysed using quantitative techniques.

3.6.1 Quantitative data analysis

I first organised the data by scoring it, determining the type of scores to use, and creating a codebook (Mills & Gay, 2019). A numerical score was assigned to each response for each question on the questionnaire. The organised data was captured for analysis with the SPSS program. A descriptive statistical technique was used to analyse the data because the research design leaned more towards the qualitative aspect. Frequencies and percentages were used to summarise the key variable thereby identifying patterns in the data.

3.6.2 *Qualitative data analysis*

The interviews were audiotaped with the permission of the participants and transcribed. Transcribed data was broken into smaller pieces and new labels were assigned to these smaller pieces of data (Yin, 2014). Codes were compared to see the emerging patterns. The comparison was based on the research questions. The coded data was grouped under different themes (Yin, 2014), namely (1) the benefits of technology for learning mathematics, (2) learners' use of technology in the school and home environment, and (3) the challenges experienced by learners when using technology to learn mathematics. The themes were deductively developed based on the research questions. The conclusions were drawn based on these themes.

3.7 Findings

In this section, I present the results obtained through the questionnaire and the interview schedule for the focus group. The results are organised according to the themes described in the analysis section. I will start by presenting the questionnaire data followed by the interview data. However, in the last theme, only interview data will be presented.

3.7.1 *Benefits of technology in mathematics learning*

This section focused on how learners perceived the value of technology in learning. The learners' questionnaire and the focus group discussion were used to obtain information on the benefits of technology in mathematics learning. Section C of the learners' questionnaire asked for information using five items on the benefits of technology in mathematics learning. Table 1 shows the percentages in terms of learners' perception of the benefits of technology in mathematics learning.

Table 1: Percentage of learner participants' perceptions of benefits of technology in mathematics learning

Item (benefits of technology in mathematics learning)	Strongly disagree		Disagree		Not sure		Agree		Strongly agree	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Experience of enhanced maths learning	2	2.5	4	5.1	11	13.9	25	31.6	37	46.8
Boosting of maths confidence through technology usage	1	1.3	5	6.3	15	19	31	39.2	27	34.2
Checking maths procedures			10	12.1	17	21.5	25	31.6	27	34.2
Routine use of technology in maths			14	17.7	10	12.1	34	43	21	26.6
Ability to link maths ideas with the help of technology	3	3.8	8	10.1	14	17.7	33	41.8	21	26.6

Note. Freq = Frequency; Perc = Percent

Table 1 indicates that the item with the highest percentage of agreement is: experience of enhanced maths learning. This implies that learners see the technology as beneficial to them. The item with the second highest percentage of agreement is: boosting maths confidence through technology use. Their percentages are 84.4 and 73.4 respectively. The remaining items also show high percentages of agreement, but the percentages are not overwhelming. Therefore, learners perceive that the use of technology in mathematics benefits their learning. During the focus group interview participants confirmed the above data in this way:

Chego (School A) said:

> *"You gain more knowledge, and you are exposed to more methods to use to solve different mathematics problems. You also get tips on how to approach some of the topics. There are more examples as compared to examples given in the textbook."*

Nsovo (School B) said:

> *"In most instances, I do not understand trigonometric functions when they are taught at school. When I have downloaded them (trig functions) on my cell phone I can practise and revise them more at home for better understanding."*

Thus, the learners showed that technology benefited them in their learning and that they were motivated to use technology in their learning. Learners can reap the benefit of technology in mathematics if they use these tools in learning. The data below shows the extent of learners' access to technology and how they use technology in mathematics learning. One form of access to educational technology tools is through ownership. Table 2 below gives the percentages of learners' technology ownership.

Table 2: Learner participants' technology ownership

Item (technology ownership)	Ownership		Non-ownership	
	Percentage	Frequency	Percentage	Frequency
Smartphone	81	64	19	15
Tablet	20.3	16	79.9	63
Other Tablet(iPad)	3.8	3	96.2	76
Laptop	24.1	19	75.9	60
Desktop Computer	31.6	25	68.5	54
Calculator	58	46	41.8	33

Table 2 shows that most learners owned smartphones and calculators. It is also important to get further information on how learners' technology ownership contributed to the way they used the technology in learning. Learners' use of technology is not confined to a specific space. Different spaces afford learners opportunities to use different tools. In this section, the focus was on learners' use of technology within the two important spaces in which they find themselves, namely within the school environment and outside it. The two spaces that were focused on in this analysis were outside and within the school environment. These two spaces can either constrain or permit learners' use of educational technology. Besides the space in which learners access technological tools, they are also influenced by the different tools they use when learning. It was therefore it was important to understand the different activities that learners were engaged in when using educational technologies within these two spaces. The regularity with which the learners preferred to perform these activities, indicated the benefits of the technology for learning.

3.7.2 *Learners' use of technology within the school and home environment*

Table 3 below indicates that most of the learners use educational technologies regularly for learning mathematics. In this study, 'regularly' was considered to be weekly or daily use of technology. However, the percentages are not overwhelmingly high.

Table 3: Learner participants' regular use of technology within the school

Item (use of technology within the school)	Never		Yearly		Monthly		Weekly		Daily	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Talking and sharing ideas about maths	16	20.3	21	26.6	10	12.7	20	25.3	12	15.2
Making maths practical	9	11.4	12	15.2	16	20.3	28	35.4	14	17.7
Persisting to solve difficult problems	12	15.2	15	19	18	22.8	25	31.6	9	11.4
Applying different approaches to solve problems	11	13.9	16	20.3	15	19	18	22.8	19	24.1
Deep maths understanding	6	7.6	14	17.7	16	20.3	19	24.1	24	30.4
Improve technology skills and knowledge	6	7.6	10	12.7	11	13.9	32	40.5	20	25.3
Improve maths skills and knowledge	11	13.9	5	6.3	18	22.8	18	22.8	27	34.2

Note. Freq = Frequency; Perc = Percent

During the focus group discussion, some participants commented on the reasons why they used technology in the school environment.

Tipa (School A) said:

> *"I use a calculator to do calculations that involve solving mathematical problems and checking if the answer I have worked out is correct."*

Rapelo (school B) said:

> *"Our teacher allows us to download the maths textbook using our smartphone. The school does not have enough copies for us all."*

Table 4 below shows that many participants use technology more regularly outside the school premises to communicate with friends and family and learn mathematics.

Table 4: Learner participants' regular use of technology outside the school

Item (use of technologies outside the school)	Never		Yearly		Monthly		Weekly		Daily	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Learning maths	12	15.2	12	15.2	17	21.5	22	27.8	16	20.3
Playing games	13	16.5	17	21.5	17	21.5	13	16.5	19	24.1
Communicating with friends and family	3	3.8	7	8.9	12	15.2	18	22.8	39	49.4
Designing and producing artefacts	40	50.6	14	17.7	5	6.3	10	12.7	10	12.7

Note. Freq = Frequency; Perc = Percent

During the focus group discussion, learners indicated the reasons why they used the technology outside the school environment.

Pulane (School A) said:

> *"Ok, at school we have laptops, but we don't have access to use them when we want, and the school Wi-Fi is secured…and again we go to the community library for the computer and the Wi-Fi."*

Taola (School B) said:

> *"I use my mother's smartphone at home because she allows me to use it there and at night it is quiet, and I can learn without disturbance."*

3.7.3 Challenges experienced by learners when using technology to learn mathematics.
In this section, the qualitative data will be presented. One of the major challenges learners mentioned when using the smartphone for learning mathematics is that they sometimes get distracted from their learning. They explained in this way:

Pela (School A) said:

> *"You can spend more time communicating with friends online using WhatsApp and forget that you are given some homework."*

Fomo (School B) said:

> *"Let us say I go to Google to search for information relating to schoolwork. While searching for the information I get a notification of a WhatsApp message from my friends, I will leave the schoolwork and focus on the WhatsApp message and continue communicating with my friends."*

The participants further indicated that lack of access to Wi-Fi was also another major challenge. They explained this way:

Tshego (School A) said:

> *"The school used to provide us with login details for the school Wi-Fi. It has stopped providing us with login details for the Wi-Fi. The school informed us that we use the internet for the wrong reasons like chatting on social media and downloading music and video. If you get little data, you must stay online"*

Thoki (School B) said:

> *"Our school has Wi-Fi, but we cannot access it. We depend on our parents to buy us data."*

However, the participants also mentioned that they could access Wi-Fi in the nearest shopping complex and the community library. According to the participants they were given 200MB of data at this indicated outlet which was not enough for them. These influenced decisions taken when prioritising activities in an online environment.

4. Discussion

Most of the learners owned and used smartphones and calculators. Learners believe that these tools will benefit their learning. These tools are mostly used for computational purposes and relief from computational burdens (Lassak, 2015). Learners used the tools for basic calculations when solving mathematics problems and checking the correctness of their calculations. These activities do not foster deep mathematics learning (Parrot & Leong, 2018). The activities that do not foster deep mathematics learning can lead to poor mathematics conceptual understanding (Parrot & Leong, 2018) The mathematical competences demonstrated by the learners were problem-solving competence and competence in the use of aids and tools (Niss & Jensen, 2002). Tools that support the acquisition of deep mathematical conceptual knowledge include among others Dynamic Geometry System (DGS), Computer Algebra System (CAS), Cabri and Geometer's Sketchpad (Albaladejo et al, 2015; Granberg & Olsson, 2015; Oldknow, 2009). These tools were not available for use in either of the schools in the study. The participants' socio-economic context clearly influences how learners use calculators and smartphones in mathematics learning (Basak & Govender, 2015; Mulwa & Kyalo, 2011).

Also, the lack of proper guidance from the teachers contributed to how the learners used the technology in learning (Lai, 2015). The technology was used as a replacement for the teacher in revising or catching up with their schoolwork. This is also consistent with learners' perceptions of the benefits of technology in mathematics learning. Learners are motivated to use the calculators and the smartphones. This demonstrates the importance of the role of the teacher in designing the activities that will enable the learners to use the technology effectively for mathematics learning (Fabian et al., 2018).

Lack of access to data seems to have a powerful influence on the way learners prioritise the decisions they make when using technology in mathematics learning. The analysis showed that more than 70% of the learners used technology outside the school environment to communicate with friends and family members. This implied that learners prioritised chatting with friends over searching for information about mathematics. Learners see family members and friends using social media for chatting. They do not see their teachers using social media for teaching and learning. The decision they make is based on their everyday experiences. This has an impact on their learning. If the available data is likely to be exhausted while chatting with friends, learning is sacrificed. The learners' socio-economic context influences them, to make choices that can compromise their learning. Teachers, schools and learners' socio-economic context are crucial in influencing learners' use of technology in learning (Agyemang et al., 2019; Namome & Moodley, 2021; Munje & Jita, 2020). The learners make choices that compromise learning

5. Conclusion and Implications

This paper explored the factors influencing learners' use of technology in mathematics learning in two secondary schools in South Africa. The intention was to understand the constraints imposed by these factors. The findings revealed that there are benefits to using technology in mathematics learning. However, the type of technology learners had access to influenced how the technology was used for learning. The two schools are from a disadvantaged socio-economic context. Thus, forming partnerships with the public and private sectors may assist the schools in acquiring technological tools that can assist learners in mathematics learning. The resources should be aligned with curriculum and pedagogy. The schooling community also contributed to challenges experienced by learners when using technology in mathematics learning. Thus, in addition to acquisition of the technological tools, there could be collaboration in terms of teacher professional development, in the effective use of technology in mathematics teaching and learning, and the development of school management teams on planning, management and implementation of technology in teaching and learning. The schools can partner with nonprofit organisations that offer teachers professional development in the use of technology in teaching and learning at no cost. The school management team can also develop policies that promote the effective use of technology in mathematics teaching and learning. These recommendations can also serve as guidelines to the provincial department when developing policies on the use of technology in teaching and learning.

6. Limitations

Because the study focused on mathematics classrooms in two schools, the results cannot be generalised beyond these classrooms. However, teachers and learners with similar contexts to those in this study may benefit from the study findings if they put them into practice. In both schools, the technologies that were used by the learners were smartphones and calculators for mathematics learning. Thus, the findings are limited to learners' use of smartphones and calculators.

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Appendix 1

A: DEMOGRAPHIC INFORMATION

1. School name
2. Learner's grade: ………………….. Learner's age: ……….
3. Learner's sex: …………………….

B: USES OF TECHNOLOGIES

1. Indicate the technology you own by means of a cross in the box next to the tool's name
   1.1 Smartphone ☐
   1.2 Tablet ☐
   1.3 Other Tablet (iPad) ☐
   1.4 Laptop ☐
   1.5 Computer ☐
   1.6 Programmable calculator ☐
2. Indicate the technology(ies) you usually use in learning mathematics and give a brief explanation of how you use the technology. Mention as many as you use.

Technology	Use

3. Please complete the table below by making a tick in one of the five boxes next to each statement. For this questionnaire, technology refers to digital tools like computers, laptops, Tablets, Smartphones, Interactive Whiteboards, Software programs, etc.

1. I use technology at school to do the following	Never	Yearly	Monthly	Weekly	Daily
Talk to other learners and teachers and share ideas about mathematics					

Connect mathematics to daily life					
Persist in solving difficult mathematics problems					
Apply different approaches when solving difficult mathematics problems					
Get a deep understanding of mathematics					
Improve my technological skills					
Improve my mathematics skills					
2. I use technologies at home to do the following					
Learn Mathematics					
Play games					
Communicate with friends and family					
Design and produce artefacts					

C: ATTITUDES TOWARDS MATHEMATICS AND THE USE OF TECHNOLOGIES

Please complete the following by placing a tick in one of the five boxes next to each statement indicating the extent of your agreement to each of the statements. If you are uncertain or neutral about your response you may always select "Not Sure". Technology is a broad concept that can mean a lot of different things. For this questionnaire, technology refers to digital tools like laptops, Tablets, Smartphones, Interactive Whiteboards, Software programs, etc.

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1. I am good at using technologies					
2. I am committed to using technology					
3. I solve technical problems myself when using technologies					
4. I always understand mathematics easily					
5. I always get good results in mathematics					
6. I solve any mathematics problem in my grade					
7. I get excited when I do mathematics					

8. I am interested to learn new concepts in mathematics					
9. A good pass in mathematics opens one's door to a great future					
10. Learning mathematics is enjoyable					
11. I get a sense of satisfaction when I solve mathematics problems.					
12. I mastered any technology used in mathematics in my grade					
13. I like using technology when learning mathematics					
14. Using technology in mathematics is worth the extra effort					
15. Mathematics is more interesting when using technological tools.					