

Learning Mathematics online during Covid-19: Experiences of selected secondary school Mathematics students in Zimbabwe

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Abstract

The implementation of social distancing regulation in response to the Covid-19 pandemic led to the temporary closure of schools across the world in 2020. Online learning became the game changer in all education systems globally. However, education in African countries was most affected due to their economic and technological backwardness. Zimbabwe was not spared. Online learning was met with mixed feelings by Zimbabwe's secondary school Mathematics students. This article presents students' experiences with online teaching and learning of secondary school Mathematics in Zimbabwe during lockdown periods. Data were collected using mixed methods technique. Qualitative data were collected through an open-ended questionnaire and quantitative data were collected through a closed questionnaire using the modified Likert Scale of SA- Strongly Agree, A- Agree, D- Disagree, and SD- Strongly Disagree. Results indicate that the majority of the learners were not fully guided to make sure that they were connected to online learning platforms. Teachers' inexperience in terms of online teaching led to challenges of tapping into affordances of technology to bridge learning gaps. Students faced mobile network and internet connectivity problems. Students indicated that there were a lot of distractions in home environments. There were learning gaps between students with necessary technological tools and their counterparts without the required tools. Lack of face-to-face feedback from peers affected students' group learning during the learning of Mathematics online. It is recommended that African governments invest heavily on the education sector in order to improve the teaching of Maths and Science subjects.

Keywords: Online learning, Covid-19, social distancing, mathematics learning

Introduction and background

Following the outbreak of the Covid-19 pandemic in 2019, educational institutions were suddenly expected to abide by the set-up of Covid-19 preventive measures which included social distancing and hygienic practices. Movements were also restricted to curtail the spread of the virus. Schools closed their doors and a paradigm shift in terms of secondary school learning prompted movement from face-to-face traditional classroom to online learning utilising digital technologies in education. The shutting down of schools across sub-Saharan Africa affected 91% of primary and secondary school learners (Anifowashe et al., 2020). Online learning was considered the best possible approach to continue the teaching and learning process during the pandemic. This move negatively affected schools with disadvantaged socio-economic backgrounds (UNESCO, 2020). A few well-resourced schools managed to keep engaging their learners with various online learning activities using WhatsApp, Google Classroom, Google Meet and Zoom. However, there was little time to initially prepare schools and teachers to implement online teaching; no guidance or expertise was availed.

Online Mathematics learning in this context is the process of assisting learners to learn Mathematics through instruction by the teacher, with the aid of Information Communication Technology (ICT) tools. In education, ICT encompasses all computing and communication facilities that variously support the teaching and learning process. However, teachers in Zimbabwe had not been trained to teach from home. This was a different ball game altogether in pedagogical approach where virtual lessons were to be prepared in place of physical lessons. Those teachers who wanted to remain relevant faced serious pressure to tap into the affordances of technology in order to bridge learning gaps. Various challenges were faced in online learning, especially in Mathematics due to its nature which required learners to make sense of the abstract mathematical concepts and phenomena building on their experiences. The news that schools would close came suddenly and, with no system-level guidance, schools had a very short time to respond with decisions about how to continue providing Mathematics learning for their pupils.

Generally, Mathematics education thrives on face-to-face teaching spaces where teachers decompress Mathematics knowledge to their students by implementing pedagogical strategies

such as inquiry based teaching and collaborative work. Given the constraints of the Covid-19 pandemic, one wondered how Mathematics learners would adapt to online teaching and learning environment. Research conducted by Kufakunesu and Madusise (2020) indicates that pupils' access and participation in online learning had been inequitable. The study reveals that the majority of learners were not fully guided to make sure they were connected to online platforms and pupils from disadvantaged socio-economic backgrounds spent less time on online learning than their more affluent peers since they were less likely to have access to ICT tools such as computers and/or other resources for online learning. Covid-19 exposed online learning disparities amongst pupils. Chen, Hsu and Hung (2000:23) cited in Mataka, Mukurunge and Billa (2020) posit that ICT tools "play different mediating roles in the instructional process: informative tools, situating tools and communicative tools". For online learning, communicative tools are central because they are the conduit of information sharing between the teacher and the learner or among learners, beyond the physical barrier of the classroom. These tools are enabling technologies which include the hardware and software necessary for delivering voice, audio, data videos and internet service from one point to another, and associated equipment via internet. According to Aluko (2011), this involves all internet-based communications as well as general use of electronic devices in storing, processing and sharing information.

Online learning demands the presence of ICT tools in schools and learners' homes. Learners need to be connected to their teachers and peers via internet and/or WhatsApp. However, UNESCO (2020) reports that 82% of students in sub-Saharan Africa do not have access to internet. Moreover, telecommunication companies do not have any student package. Their prices for internet services are very high. As a result, many students cannot afford the internet cost. It is during these times of Covid-19 that the non-availability of ICT tools is disadvantaging children from the marginalised societies in their online learning activities. There is need to leverage on the use of technology to support the delivery of education. This is despite the fact that it is capital intensive for developing countries, especially African countries. The Covid-19 pandemic arrays opportunities and perceptions to be innovative, creative, radical and versatile in advancing our education system. Teaching is the process of assisting an individual to acquire knowledge, skills and attitudes through instruction. Alaribe and Nwobu (2010) argue that

teaching is the process of helping an individual to learn through instruction. This article explores the online learning experiences of secondary school Mathematics students in Zimbabwe during Covid-19 lockdowns.

Statement of the Problem

The closure of schools for face-to-face teaching/learning to curb the spread of the Covid-19 pandemic led educational institutions in Zimbabwe to embark on online learning. Online learning then became a compulsory alternative in order to continue with education during the lockdown in 2020. This came as a shock to teachers and their students who were not well-advised on the operational use of ITC tools for teaching and learning and some who had never witnessed e-classes in their lives. Online classes presented the flexibility necessary to contain the spread of the virus and maintained uninterrupted academic work. However, its use in teaching subjects which require abstraction seemed challenging. Hence, there was the need to consider the views and experiences of the secondary school students on the effects of the Covid-19 pandemic on their academic lives, challenges and benefits during online Mathematics learning at home. The study, therefore, aimed at exploring the students' experiences with online Mathematics learning in selected Zimbabwean secondary schools.

Research Question

The study addresses the following central research question:

What are the online learning experiences of secondary school Mathematics students in Zimbabwe?

Theoretical Framework

The development of information and communication technologies has undergirded the emergence of new forms of discourse and has the potential to change social relations and the ways in which we understand the development of knowledge (Clay et al., 2012). Social constructivist learning theory, as proposed and developed by Vygotsky, informs this study. The theory illuminates the specific system that connects online learning and its sociocultural settings, especially in times plagued by the Covid-19 pandemic. Following Vygotsky, interaction in online learning contexts allows the much-needed learning in Mathematics, where

one has to engage with peers, critical friends, and experts to achieve certain outcomes. Participation and construction of meaning is scaffolded by social artifacts such as collaboration and sharing of narratives in online forums. Discussion and arguments among participants affects the potential for knowledge construction (Borba & Llinares, 2012). It is also believed that knowledge construction in collaborative settings assumes that the nature of participation and content discourse is related to how the process of construction of knowledge is developed. The ICT tools provided in the specific online contexts can provide different ways of articulating the discourse in collaborative contexts which are needed in the Mathematics teaching and learning scenarios. In such contexts, mathematically significant pedagogical opportunities for Mathematics teaching and learning that build on student thinking may emerge.

Review of Related Literature

Online teaching and learning is a method of education that focuses on technology and pedagogy that are integrated into the education process, and students can communicate easily online and from a distance. According to Stern (2018) online learning or e-learning is a form of education that takes place over the internet across distances and not in the traditional classrooms. The less privileged engage in online learning through WhatsApp. To improve the accessibility and provision of online learning, ICT tools are used, offering innovative pedagogy and distance learning. According to Montel (2018) online learning education has progressively evolved as technology itself has more to offer in terms of educational tools. Online learning has become a popular and much-needed pedagogy during the Covid-19 pandemic lockdown in that it offers the possibility to attend remote classrooms without having to be physically at the rooms (Alvarado & Calderon, 2013).

Covid-19 has turned online conveniences into daily necessities. Marpa (2021) analysed teachers' attitudes in the use of technology in teaching Mathematics during Covid-19 pandemic. The study concluded that using technology in teaching Mathematics, considering the Covid-19 pandemic situation, is vital in order to bring about teaching and learning that is meaningful to both teachers and learners. Paudel's (2021) research report on online learning

during the Covid-19 pandemic indicates that 60% of the participants suggested that both the instructors and learners should have self-learning motivation, should cooperate with each other and should follow the ethics of technology. The same report reveals that 56% of the participants reported that online teaching should not be the replication of traditional teacher-centred lecture methods. Rather, more focus should be on engaging individual learners as per their abilities. Technology can provide more real-time teaching methods, but there is also need for an active communication between teachers and their students and for opportunities to share experiences with colleagues (Niemi & Kousa, 2020).

The argument on how collaborative multimodal technologies support the construction of knowledge was reported by Centros-Araiyo and Glanidis (2020). They reported on the use of different tools for online collaborative mind mapping activities. Mind maps in this case were understood as ways of visualising Mathematics education knowledge that is collaboratively constructed using different technological tools to support and organise topics. They also reported on the role played by cognitive scaffolding, such as feedback from others and prompts to carry out the activities. Sharing and co-creating tools generate the context in which participants can compare and share ideas, and justify and evaluate their arguments. The current study, thus, sought to establish how students and teachers interacted with each other in online Mathematics teaching and learning as reported by students.

Oechesler and Borba (2020) investigated how the creation of videos with mathematical content by students themselves could become a teaching and learning tool. They found that video production provided a classroom dynamic in which students could act as principal figures of the teaching and learning process, with teachers mediating the activities. Video production was found as a different way of expressing Mathematics and well-suited for expressing what students understood. Through video production, students showed their understanding of content and also became aware of their difficulties and sought ways to overcome them. Videos as a teaching and learning tool define new practices in Mathematics education. In their study on the effects of using online learning in the teaching of physics of fluid mechanics during the Covid-19 pandemic, Sofi and Laafon (2020) found out that learning by mobile technology through the Google Classroom was effective. It also proved that the use of Google Classroom

provided an important solution to integrating technology in teaching and learning. Students suggested the need for continuous training on the effective use of ICT and online education platforms, the need to improve interface and content of the platform by different formats and by different educational resources such as explainable videos, and the need to provide infrastructure and material (smartphones, laptops, internet and others) to students who did not have these facilities to successfully continue with online courses. From the students' suggestions, it became obvious that they accepted and appreciated the idea of online learning of fluid mechanics through the Google Classroom platform. The studies cited above highlight some of the benefits likely to accrue from the use of ICT tools in online learning. This article presents the experiences and perceptions of secondary school Mathematics students on online Mathematics learning in Zimbabwe during the Covid-19 pandemic.

Information Communication Technology Used by Teachers and Students During the Covid-19 Pandemic

Google Classroom: An online platform designed by Google for the purpose of teaching and learning. Google created the platform to help learners and educators communicate and collaborate, thereby encouraging paperless classroom engagements. The teacher just needed to create and distribute files (exercises, links, videos, assignments, homework, etc.) to their students online and to provide comments and exchanges between him and the students on educational documents or on all tasks in Google classroom. It is an educational tool that uses a two-way communication ensuring feedback on teaching and learning engagements.

Zoom: This is an educational tool which also allows simultaneous engagement of many participants using video and audio sharing. It can be used to record classroom engagements and then transcribe the automatically. Because of its wide coverage, Zoom was one of the most used platforms for teaching and learning during this pandemic.

Google Meet: Unlike Zoom, Google-Meet uses a limited number of participants. It is a user-friendly educational tool where the teacher can invite all his/her students (provided they are less than one hundred) to a meeting/lesson. It can also be used to record classroom engagements and then transcribe automatically.

WhatsApp: it is an online social media platform which runs on mobile devices particularly the Android and iPhone. It was one of the most widely used online platforms during this Covid-19 pandemic between the teachers and the learners and it allows them to exchange videos, audios and written texts as a means of imparting knowledge without using internet. Users can also use it through desktop computers with internet connection.

From literature, all the above four online platforms were used by students and teachers during Covid-19 lockdown with the less privileged engaging more through WhatsApp.

Methodology

The study adopted a mixed methods research design where qualitative data were collected using an open-ended questionnaire and quantitative data were collected through a closed questionnaire using the modified Likert Scale of SA- Strongly Agree, A- Agree, D- Disagree, and SD- Strongly Disagree. The participants were selected by their Mathematics teachers using stratified random sampling with an assumption that they had all been exposed to online Mathematics learning during school closure. The stratified random sampling method is a sampling technique in which the distinct categories of sample members are proportionately represented in the ultimate sample (Munzara, 2016:12; Kufakunesu & Chinyoka, 2017). According to Braun and Clarke (2013) stratified random sampling is a sampling technique in which a given population is divided into non-overlapping categories before members of each stratum are selected in proportion to the size of the layer relative to the entire population.

The sample size of the participants who responded to the survey was seventy-five ‘O’ Level Mathematics students and fifty ‘A’ Level Mathematics students with ratio in percentage being 60% to 40%. respectively. The students who participated in the study were from Masvingo and Midlands provinces of Zimbabwe. Participating schools were purposively selected to consider schools which run up to “A” level and schools from varied economic backgrounds. This enabled the researcher to get the experiences of students coming from different economic statuses, including urban and rural backgrounds, and to compare experiences of “O” and “A” Level students. One urban school and two rural schools (one boarding school and one-day school) from Midlands Province participated and three urban schools (two boarding schools

and one day school) and two rural schools from Masvingo Province participated. All in all, eight Zimbabwean secondary schools which ran up to "A" level participated in the study. For all the participants, Mathematics was one of their study areas during lockdown when lessons were carried out in the learners' home environments. The researcher designed questions in both questionnaires to capture Mathematics online learning experiences of the students during lockdowns. Both questionnaires consisted of a set of questions on:

- Personal information of students;
- Characteristics of mobile devices used and availability of connection tools;
- Training of students in ICT;
- Degree of satisfaction of the students to learn Mathematics using online pedagogical activities;
- Students' opinions of steps, the operation and difficulties in using ICT tools;
- Comparison between face-to-face methods and the mobile technology methods;
- The value of online materials in meeting students' mathematical needs; and,
- Students' suggestions on best practices to improve the teaching and learning of Mathematics online;

Schools in Zimbabwe were closed on 24 March 2020 and re-opened for examination classes on 28 September 2020. During the school closure students were exposed to online Mathematics learning to avoid being rusted at home. The searched experiences were those of learners who learned from home during the lockdown period from July 2020 to September 2020. The research was carried out in October 2020, soon after the re-opening of school doors to examination classes. Some of the participating students submitted that schools sent memos to parents informing them that students were going to be introduced to online learning in July 2020 to mark their second term. Parents were also requested to provide their children with working e-learning gadgets such as smart phones, tablets or laptops and good internet connection to connect to Google Classroom – for notes and assignments, GoogleMeet and Zoom, for live lessons and WhatsApp, mainly for notices. Participants from rural schools indicated that parents/guardians were encouraged to provide their children with gadgets which could connect to WhatsApp as they mainly used WhatsApp in their online learning. Teachers created subject based WhatsApp groups and started posting meeting IDs and passwords inviting students to join classes. This marked the commencement of online learning in

Zimbabwe. All the teachers in the study used WhatsApp Since WhatsApp was used as a means of communication. Some lessons, particularly those done on Zoom and Meet, were scheduled according to given timetables accommodating all the subjects. However, there were some unscheduled lessons especially those on WhatsApp and Google Classroom where learners could participate at different times.

In this research, the learning environment is based on the use and efficiency of ICT tools in the learning process. Administration of the questionnaires was done through their Mathematics teachers who distributed and collected the questionnaires after completion. The ‘O’ Level students completed the closed questionnaire and the ‘A’ Level students completed the open-ended questionnaire. The choice of questionnaire respondents was done with an assumption that due to maturity the ‘A’ Level students would better express themselves as compared to their juniors, the ‘O’ Level students. Since the administration of questionnaires was done by class teachers, a maximum response of 100% was achieved in questionnaire completion.

To validate the research done and to find the answers to the guiding research question, descriptive statistics such as frequency counts and simple percentages were used to analyse data from closed questions. Qualitative description based on responses from open-ended questions was given to make a more detailed analysis of the results from each response to the questions.

Results and Discussion

A gender balanced sample of 125 respondents, that is, 75 Ordinary Level Mathematics students and 50 Advanced Level Mathematics students was obtained using the stratified random sampling method.

Table 1: Information Communication Technology Tools Used by Students

Personal Information		Frequency N=125	Percentage N=100
ICT Tools used	Laptop	14	9.65
	Smartphone	122	84.14

Possession of ICT tools used	Tablet	6	4.14
	Desktop	3	2.07
	Own	95	76
	Parent/Guardian	22	17.6
ICT Platforms used	Others	8	6.4
	WhatsApp	96	53.3
	Google Classroom	30	16.7
	Zoom	29	16.1
	Google Meet	25	13.9
Smartphone band width	2 G	39	0.32
	3 G	72	0.59
	4 G	11	0.9

The table above shows the types of ICT tools used by secondary school students to learn Mathematics online during lockdown. It can be seen that the majority of learners, 84.14%, used smartphones, followed by 9.65% who used laptops. The least number, 2.07%, used desktops. However, most of the smartphones had 2G or 3G (91%) network connectivity and had problems with connecting to Zoom meetings, Google Classroom and Google Meet. As a result, 16.7%; 16.1% and 13.9% used Google Classroom, Zoom and Google Meet platforms, respectively. It was even noted that these platforms were not consistently used due to poor connectivity of their ICT tools. WhatsApp was used by 53.3% and these were mainly from rural schools. The 16.7% who used Google Classroom were generally from urban schools. Those students who were using their parents'/guardians' gadgets were not always in possession of the gadgets. There was high possibility of missing some online lessons. For the 76% who had their own gadgets, most owned 2G and 3G smartphones. Eight students indicated that they

used borrowed gadgets from other relatives. Students did not stick to using the same platform due to non-availability of reliable gadgets.

On a positive note, students indicated that work sent via Google Classroom was again posted on WhatsApp to accommodate those who could not connect to Google classroom. Ninety-six students indicated that they were using WhatsApp. Since students could use more than one platform, a total of one hundred and eighty students indicated having used the four platforms cumulatively. This number exceeded one hundred and twenty-five students who participated in the research. The overlap was due to the same students using different platforms.

Online Learning Experiences During Covid-19 Lockdown

Table 2: Responses of ‘O’ Level students

Number = 75

Learning experiences	SA	A	D	SD
I was not trained on how to connect to online learning platforms at school	8 10.7%	67 89.3%	-	-
I did not have sufficient knowledge and skills in the use of ICT tools for learning	11 14.7%	57 76%	7 9.3%	-
I found learning mathematics on line difficult	17 22.7%	52 69.3%	6 8%	-
Most times I failed to access e-learning systems	12 16%	19 25.3%	38 50.7%	6 8%
Many Mathematics problems were difficult to solve online	22 29.3%	36 48%	16 21.3%	1 1.4%
Learning Mathematics online is frustrating	12 16%	43 57.3%	15 20%	5 6.7%

I missed fruitful discussions with my teacher and classmates	17 22.7%	43 57.3%	12 16%	3 4%
Face-to-face remains the most reliable method of teaching and learning Mathematics	11 14.7%	50 66.7%	12 16%	2 2.6%
I sometimes run short of data bundles to connect to online learning platforms	14 18.7%	52 69.3%	9 12%	-
I enjoyed learning Mathematics online	12 16%	18 24%	35 46.7%	10 13.3%
When failing to understand I gave-up	14 18.7%	19 25.3%	27 36%	15 20%
Online lessons were too short for group activities	25 33.3%	34 45.4%	14 18.7%	2 2.6%
Materials provided online did not meet my personal mathematical growth and interest	18 24%	36 48%	17 22.7%	4 5.3%
Mathematics is difficult to be understood online	17 22.7%	42 56%	9 12%	7 9.3%
Our teacher gave us adequate online Mathematics activities	12 16%	24 32%	33 44%	6 8%
My ICT learning tool was reliable	15 20%	22 29.3%	30 40%	8 10.7%
I had power challenges	17 22.7%	37 49.3%	15 20%	6 8%
I had done online work on Mathematics in my school before the lockdown	6 8%	11 14.7%	48 64%	10 13.3%

Teachers used different platforms to enable us to participate during online learning	16 21.3%	19 25.3%	27 36%	13 17.4%
Submitting Mathematics assignments online is not easy	22 29.3%	36 48%	12 16%	5 6.7%

SA- Strongly Agree, A- Agree, D- Disagree, SD- Strongly Disagree

Table 2 shows secondary school students' Mathematics online learning experiences as expressed by 'O' level students who responded to the closed questionnaire. All the students agreed that they had not been trained on how to connect onto online learning platforms at school. As a result, 90.7% agreed that they had no sufficient knowledge and skills in the use of ICT tools for learning. 92% agreed that they found learning Mathematics online difficult and 41.3% agreed that they failed to access e-learning systems most of the times. 73.6% agreed that learning Mathematics online was frustrating. 80% agreed that during online Mathematics learning they missed fruitful discussions they used to have with their teachers and classmates during face-to-face Mathematics classes, and 81.4% agreed that face-to face remains the most reliable method of teaching and learning Mathematics. Only 40% agreed that they enjoyed learning Mathematics online and 78.7% agreed that many Mathematics problems were difficult to solve online. As a result, 44% agreed that they gave up after failing to understand. 78.7% agreed that online lessons were too short for group activities and 72% agreed that materials provided online did not meet their personal mathematical growth and interest, while 78.7% agreed that Mathematics was difficult to understand online. 48% indicated that their teachers gave them adequate online Mathematics activities and 49.3% had reliable ICT learning tools. 72% had power challenges. Only 22.7% agreed that at some point they had online work on Mathematics at their schools before lockdown. 46.6% agreed that their teachers used different platforms to enable them to participate during online learning but 77.3% found submitting Mathematics assignments online difficult, while 88% of the respondents indicated that they sometimes ran short of data bundles to connect to online learning platforms.

The results from the above findings reveal that all the secondary school Mathematics students were not fully guided to make sure that they were connected to online learning platforms. School closures due to the Covid-19 pandemic posed problems (particularly to vulnerable groups of students) such as how to make successful transition to online learning at home (OECD, 2020). Evidence shows that in nearly all countries' remote learning strategy responses to the Covid-19 crisis, insufficient attention has been paid to inclusion of all learners and that most vulnerable groups of students have been left out (UNESCO, 2020). Since most students (90.7%) indicated that they had no sufficient knowledge and skills in the use of ICT tools for learning, there is need to leverage on the use of technology to support the delivery of education, despite the fact that it is capital intensive. Covid-19 pandemic arrays opportunities and perceptions to be innovative, creative and radical in advancing our education system, thus, positive experience. Mahaye (2020) argues that establishing a sustainable and integrated parallel system for learning online and to provide a fallback arrangement as usual learning engagements is, therefore, very important. In Africa, it should be noted that e-learning is not only needed in our educational sector because of the present unprecedented happenings, but that there is need to equip the learners as well as the educators with the 21st century skills for them to compete favourably with their contemporaries globally.

The lack of knowledge and skills in the use of online ICT tools and failure to access e-learning systems resulted in students finding online learning of Mathematics difficult and frustrating. The emergence of the Covid-19 pandemic exposed the lapses and shortages in African countries' education system for the world to see, particularly in non-digitalisation of the sector. By agreeing that face-to-face remains the most reliable method of teaching and learning Mathematics, secondary school students submitted that e-learning was not practicable. This submission questions our readiness in the community of 21st century nations to transform the beauty of teaching and learning using the current ICT tools into a reality for all. It was disheartening to note that most students (88%) agreed that they sometimes ran out of data bundles to connect to online learning platforms. Therefore, there was no equity in participation. Disadvantaged students participated less and had less engagement due to limited data bundles. Such students experienced low level of parental/guardian support.

The majority of students (80%) agreed that during online Mathematics learning, they missed fruitful discussions they used to do with their teachers and classmates during face-to-face Mathematics classes. This shows that the two-way communication between students and their teachers and between students and their classmates remains irreplaceable in Mathematics learning. In Mathematics learning, students need scaffolding or additional support from their teachers and peers. Casey and Evan (2011) posit that teachers should optimise student engagement and success, foster interaction between students and content, and amongst students. The limited opportunities to engage in mathematical talk, metacognitive activities and receiving formative feedback negatively affected students during online Mathematics learning. The fact that 78.7% agreed that online lessons were too short for group activities and that materials provided online did not meet their personal mathematical growth and interest indicates the need for teachers to prepare impactful lessons and activities at the appropriate time, group and regroup students for collaborative learning and continuous assessment for mastery. When it comes to learning Mathematics online, even pupils with necessary technological tools still face challenges. Teachers should increase their levels of interaction with students, ask them for feedback on the online learning and provide clear information to students.

Results from 'A' Level Students

Table 1 show that most of the smartphones used by students were 2G and 3G and these are known to be very slow in internet connectivity. Lack of Wi-Fi, internet bundles and power cuts also contributed to connectivity challenges faced by the students. Technical failure in using software designed for online Mathematics learning was mentioned by the majority of Advanced Level Mathematics students as one of the inherent challenges of learning Mathematics in the Covid-19 era. As a result, some of the planned lessons could not take-off according to the planned time. One respondent made the following contribution:

Lack of stable Wi-Fi made it almost impossible to continue engaging in Google Classroom. In most situations the internet was on and off. It was only fortunate that the same work sent via Google Classroom was again sent via WhatsApp.

Another respondent had this to say:

I used to face very frequent internet disconnections during online lessons daily. It was very hard for me to follow the lessons. The second big issue was that most of our teachers had no experience in delivering online lessons. There was wastage of time every day because of technical problems.

This poor connectivity and lack of ICT tools at home might increase economic inequalities in educational outcomes. The students also reiterated that they had challenges in trying to enter the Google Classroom, Google Meet or Zoom platforms through the invitation of their teachers. The students indicated that they were, together with their teachers, not adequately trained for online learning before the Covid-19 pandemic. They said that this led to time wasting during lessons. According to the “A” Level students, teachers took unnecessarily longer time to set-up their planned lessons on either Zoom or Google Meet. They suggested the presence of the more knowledgeable ones to guide them through. Online learning environments proved not to be very conducive. Some students reported having some difficulties in completing and submitting assigned work. Lack of reliable ICT tools hindered students from achieving their goals as reported by quite a number of students. Also, teachers gave fewer demonstrations on virtual as compared to what they used to do in face-to-face lessons. The respondents almost unanimously lamented that attempting to study Mathematics without the direct assistance of competent and qualified teachers was a mammoth task. One male student had this to say:

In my opinion, non-verbal communication like eye contact with the teacher is essential to establish learning process. Face-to-face learning allows discussions among students which is very helpful for clearing a lot of concepts.

Students expressed disapproval of the adjustment to online learning indicating that the abstractness of some Mathematics content could not be taught online. It needed the physical presence of the teacher to guide them through more than teaching them electronically. Students also expressed displeasure at the time allocated to online lessons as compared to face-to-face lessons. They indicated that the time was rather too short to engage in fruitful activities. Online lessons were generally too short, maybe to serve connectivity bundles. This time difference affected their learning abilities during the Covid-19 outbreak period. Frid (2002) argues that it is difficult to explain mathematical concepts online. Some respondents (thirty-eight students)

reiterated that their home environment was not conducive to online Mathematics learning. One respondent lamented:

Most of the times, I did not find a suitable place at home for taking my online classes and I felt like the environment at home is not suitable for attending online lessons.

From the students' reports on their Mathematics online learning experiences, it is hard to accept that online learning will eventually replace physical classrooms in future. For this transition of learning from the four corners of the classroom to the borders of virtual reality, every learning institution needs to study how successful online learning has been in providing quality education to students (Basilaia & Kvavadze, 2020). The students feared that the technical challenges they encountered in their efforts to participate in the online classes could negatively influence their overall performances for the academic session. However, some students reiterated that the good thing about online learning was that learners were not left to rot at home. At least, they had something scholarly to occupy them. Those were some of the positive and enriching experiences.

Discussion of Findings from “O” Level and “A” Level Mathematics Students

Cognisant of the findings from both Ordinary and Advanced Level groups, it can be noted that there is a thin line separating the views of the research participants. The fact that the researcher used two different questionnaires (open-ended questions in one and closed questions in another) in data collection and obtained almost similar results showed that the findings were authentic. The closed questionnaire was a pointer to some experiences encountered by secondary school Mathematics students, in particular O' Level students whilst the open-ended questionnaire provided explanations to those pointers. The findings provided both positive and negative experiences. The variable that seems to cut across groups was that students felt learning Mathematics online was not all that easy. Both groups alluded to the fact that it would be ideal to have face-to-face lessons as compared to online lessons. Student-participants felt that face-to-face lessons were more advantageous as students could engage in two-way interactions with their teachers and colleagues and thus promoting fruitful discussions.

80% agreed that during online Mathematics learning they missed fruitful discussions they used to have with their teachers and classmates during face-to-face Mathematics classes. 81.4%

agreed that face-to-face learning remains the most reliable method of teaching and learning Mathematics (an extract from O'Level data analysis):

In my opinion, non-verbal communication like eye contact with the teacher is essential to establish learning process. Face-to-face learning allows discussion among students which is very helpful for clearing a lot of concepts (a quoted statement from an "A" Level student).

Connectivity problems were faced by both groups. One of the A' Level students had this to say:

I used to face very frequent internet disconnections during online lessons on a daily basis and it was very hard for me to follow the lessons.

From the O' Level students, the following analysis was reached:

It was disheartening to note that most students (88%) agreed that they sometimes ran out of data bundles to connect to online learning platforms. Therefore, it can be noted that the provision of online Mathematics teaching and learning to both groups was just a stop gap measure as it scratched on the veneer of the topics.

Conclusion

The goal of learning Mathematics online was to enable the students to study in the comfort of their homes during Covid-19 lockdown. However, from the findings, the students in this study did not quite successfully achieve that goal due to the following highlighted experiences: lack of reliable ICT tools to access online platforms; failure to connect to internet; unaffordable internet and cost of data bundles as well as erratic electricity provision. Baytiyeh (2019) argues that maintaining learning and communication by any means during school closure is important. This was reported in the study as a positive achievement of online learning. For students to fully benefit from any learning process they need to be provided with the necessary environment that could make them active in developing their knowledge (Hestenes, 2012). The findings of this study have implications not only for Zimbabwe as a developing country

but also other developing countries as well, especially African countries that experienced school closure during Covid-19 lockdown.

Recommendations

The study recommends the following:

- Schools should establish comprehensive strategies that prepare students to use online learning platforms. These strategies may include providing students with internet connecting vouchers and incremental training on the use of ICT tools. This would be a way of being proactive with student education learning prior to a crisis such as the Covid-19.
- The country's education sector should offer online courses in Mathematics Education via online instructors and tutors. This can be done via the radio or television programs.
- Internet service providers should improve the capabilities and capacities of schools to be able to deliver education online.

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