



Using Social Media Pedagogies to teach School Mathematics in a selected Zimbabwean school during the COVID-19 Pandemic

Lillias Hamufari Natsai Mutambara¹  & Maria Tsakeni¹ 

¹ Department of Mathematics, Natural Sciences and Technology Education, University of the Free State, South Africa.

ABSTRACT

The COVID-19 pandemic tested teachers' and learners' resilience to continue teaching and learning with the limited use of traditional classrooms. What became apparent was the need to find alternative ways to maintain the interactions between the teachers and the learners. This study explored the teaching and learning of secondary mathematics during the COVID-19 pandemic based on the community of inquiry framework. An explorative single case study design with forty learners and seven teachers from a rural school in Zimbabwe as participants was used. The purposive selection of the participants was based on their experiences of emergency remote learning and classes where COVID-19 protocols were observed. Data were collected through open-ended and closed questionnaires given to learners and structured and semi-structured interviews conducted with teachers. The qualitative data were analysed through thematic content analysis techniques. The findings show that in the wake of limited access to sufficient educational technologies and internet connectivity, teachers had to find alternative ways to teach mathematical problems by using already worked-out examples and voice notes, thereby reducing the teaching presence and teacher-learner interactions. However, the reduction of the teaching presence was compensated by increased self-regulated learning as learners tried to make sense of the examples shared through social media tools. The study recommends building teachers' technological and pedagogical knowledge to teach mathematics using cheap social media applications to improve the teaching, social and cognitive presence.

Correspondence

Maria Tsakeni

Email: TsakeniM@ufs.ac.za

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INTRODUCTION

Mathematics introduces learners to concepts, skills and thinking strategies that are essential in everyday life, and, as is the case in Zimbabwe, it aids learning across the curriculum. However, many researchers argue that many students find the subject difficult. Efforts are on-going through research and practice to resolve problems of poor learner performance in mathematics. However, while trying to make such determinations to find strategies to improve the pass rates, Malizia indicated that COVID-

19 was declared a global pandemic on the 11th of March 2020.¹ Just like other countries, Zimbabwe was not spared by the COVID-19 pandemic. According to Mulenga and Marbán, the education system in Zimbabwe was based on a traditional face-to-face environment and thus required the students to attend school daily.² UNESCO accedes the closure of schools was not ideal for supporting learners' ongoing cognitive, affective and skills development.³ In order to provide learning opportunities in the wake of school closures in Zimbabwe, radio and television broadcasts of lessons were launched in June 2020, while some schools and tertiary institutions introduced online learning.⁴

The transition from traditional face-to-face to e-learning was sudden and made the learning experience entirely different for all students. However, according to the Zimbabwe School Examinations Council (ZIMSEC) report, the results of the November 2020 examinations were poor, with some schools recording zero percent pass rate. The question then was, did learning take place during the lockdown period? Were the learners exposed to adequate knowledge of e-learning? Is it that the learners faced challenges in using this mode of learning implemented by stakeholders? Barrot et al. argued that there is limited information available regarding the strategies used to overcome online learning challenges.⁵ Against the preceding backdrop, this study sought to answer the following questions:

1. How did the COVID-19 pandemic affect the teaching and learning of mathematics in secondary schools?
2. What possible measures can be employed to mitigate mathematics teaching and learning challenges experienced during the pandemic?

The study's findings will build on the literature on teaching and learning during the COVID-19 pandemic emergency remote learning and what we can learn from the experience.

LITERATURE REVIEW

The COVID-19 pandemic impacted all areas of society, so the education system was not spared. Jaradat and Ajlouni asserted that the pandemic brought many challenges to the education system since the learners, key workers and teachers were left vulnerable. The vulnerability stemmed from the dangers posed to their health and the need to create new ways of teaching and learning.⁶ Thus, implementing online and virtual learning was one of the solutions to enable learners to attend classes. Lockee advocated for a swift shift from face-to-face learning to virtual classrooms in which e-learning tools such as Google classrooms, Skype and blogs became handy.⁷ Learners were separated from their teachers; hence there was a need to find other ways of learning besides face-to-face learning.⁸

¹ Nicola Malizia, "Alcohol Behaviour and Consequences during COVID-19. A Research in Italy on a Sample of University Students.," *Research Square*, May 5, 2021, 1–16, <https://doi.org/10.21203/RS.3.RS-442632/V1>.

² Eddie M. Mulenga and José M. Marbán, "Is COVID-19 the Gateway for Digital Learning in Mathematics Education?," *Contemporary Educational Technology* 12, no. 2 (April 18, 2020): 269, <https://doi.org/10.30935/cedtech/7949>.

³ Global Education Monitoring Report, *Global Education Monitoring Report, 2020: Inclusion and Education: All Means All*, *Global Education Monitoring Report 2020: Inclusion and Education: All Means All* (UNESCO, 2020), <https://unesdoc.unesco.org/ark:/48223/pf0000373718>.

⁴ Robin Muchetu, "E-Learning and Its Tragedies," *The Herald*, June 10, 2020, <https://www.herald.co.zw/e-learning-and-its-tragedies/>.

⁵ Jessie S. Barrot, Ian I. Llenares, and Leo S. del Rosario, "Students' Online Learning Challenges during the Pandemic and How They Cope with Them: The Case of the Philippines," *Education and Information Technologies* 26, no. 6 (November 28, 2021): 7321–38, <https://doi.org/10.1007/s10639-021-10589-x>.

⁶ Suhair Jaradat and Aseel Ajlouni, "Undergraduates' Perspectives and Challenges of Online Learning during the COVID-19 Pandemic: A Case from the University of Jordan.," *Journal of Social Studies Education Research* 12, no. 1 (2021): 149–73, www.jsser.org.

⁷ Barbara B. Lockee, "Online Education in the Post-COVID Era," *Nature Electronics* 4, no. 1 (January 25, 2021): 5–6, <https://doi.org/10.1038/s41928-020-00534-0>.

⁸ Barrot, Llenares, and del Rosario, "Students' Online Learning Challenges during the Pandemic and How They Cope with Them: The Case of the Philippines."

Learning during the pandemic inspired researchers to conduct various studies. Barrot et al. studied the challenges that students in the Philippines faced as they used online learning during the pandemic. The results revealed that the pandemic brought serious challenges to the education system in the Philippines. The challenges observed were failure to complete tasks, disturbances at home, technological illiteracy, poor network coverage and health problems caused by prolonged use of online gadgets.⁹ They added that students had to cope with the challenges by utilizing available resources, developing sound time management skills, joining Facebook groups and seeking assistance online from teachers and peers.¹⁰

In another study, Singh et al. focused on students' online learning experiences during the COVID-19 pandemic. The study revealed that students preferred traditional face-to-face classroom learning to online learning.¹¹ Adarkwah conducted a similar study in Ghana and found that students thought online learning was ineffective as it was associated with several challenges. The most common challenges found were lack of peer interaction and lack of resources.¹² Day et al. widen the geographical area of study by carrying out a study at six institutions in three different countries. The results of the study were not different from those found by other researchers. The study found that online learning was not students' favourite way of learning. The students associated online learning with some challenges that included a shortage of resources, lack of access to laboratories and stress.¹³ Contrary to the results of the other studies, Khalil et al. found that medical students in Saudi Arabia felt that online learning was more effective than face-to-face learning. However, the medical students complained that online learning had its challenges that included poor network connectivity and failure to address hands-on practical activities.¹⁴

Some of the challenges and experiences can be explained based on the Community of Inquiry (CoI) framework that Garrison and Arbaugh claim has been popularised as a framework to study online learning.¹⁵ Based on the CoI in Figure 1 below, an educational experience in online platforms is made possible through an intersection among teaching presence (what the instructor does to facilitate learning), social presence (a sense of being part of a group in ways that enable learning) and cognitive presence (being able to construct meaning for learning). These components are also supported by other actions, which are selecting content, setting the climate, supporting discourse and creating a communication medium. In this paper, the challenges that were experienced and the measures to mitigate the challenges of teaching and learning mathematics in secondary schools were studied based on the CoI lens.

⁹ Barrot, Llenares and Del Rosario, "Students' online learning challenges during the pandemic and how they cope with them."

¹⁰ Barrot, Llenares and Del Rosario, "Students' online learning challenges during the pandemic and how they cope with them."

¹¹ Kuldeep Singh et al., "Medical Education During the COVID-19 Pandemic: A Single Institution Experience," *Indian Pediatrics* 57, no. 7 (July 4, 2020): 678–79, <https://doi.org/10.1007/s13312-020-1899-2>.

¹² Michael Agyemang Adarkwah, "An Outbreak of Online Learning in the COVID-19 Outbreak in Sub-Saharan Africa: Prospects and Challenges," *Online Submission* 21, no. 2 (2021): 1–10.

¹³ Terence Day et al., "The Immediate Impact of COVID-19 on Postsecondary Teaching and Learning," *The Professional Geographer* 73, no. 1 (January 2, 2021): 1–13, <https://doi.org/10.1080/00330124.2020.1823864>.

¹⁴ Rehana Khalil et al., "The Sudden Transition to Synchronized Online Learning during the COVID-19 Pandemic in Saudi Arabia: A Qualitative Study Exploring Medical Students' Perspectives," *BMC Medical Education* 20, no. 1 (December 28, 2020): 285, <https://doi.org/10.1186/s12909-020-02208-z>.

¹⁵ D. Randy Garrison and J.B. Arbaugh, "Researching the Community of Inquiry Framework: Review, Issues, and Future Directions," *The Internet and Higher Education* 10, no. 3 (January 2007): 157–72, <https://doi.org/10.1016/j.iheduc.2007.04.001>.



Figure 1. Community of inquiry framework¹⁶

METHODOLOGY

Research design

The study employed the qualitative approach in the form of an explorative case study. Creswell and Creswell describe qualitative research as exploratory in nature as it helps researchers discover more about the challenges teachers face during the pandemic in teaching and learning mathematics.¹⁷

Participants

A purposive sampling method was used in this study to select both teachers and learners. Purposive sampling is a feature of qualitative research whereby researchers intentionally select cases that are accessible and have information on a specific theme or a particular issue.¹⁸ The study participants were forty learners and seven teachers from a government high school in Zimbabwe. The school is situated in a rural area in Zimbabwe. The learners were in the exit class (Form 6) and were due to write their final high school examinations. All the teachers selected were mathematics teachers teaching Form 1 to Form 6 classes at the selected schools. The study was conducted in the 2021 academic year amid the COVID-19 pandemic when learners had just returned to school.

Instruments and data collection

Questionnaires for the students and interviews with the teachers were the two instruments considered appropriate for the study. Permission to conduct research was sought from the Ministry of Education and the schools. The participants were assured that the collected data would be treated as confidential and anonymous. The participants had a right to withdraw at any stage of data collection and signed consent forms indicating their willingness to participate in the study. For anonymity, fictitious names were used for the teachers and coded using the tags 'T1', 'T2' up to T7, where the order did not have

¹⁶ Garrison and Arbaugh, "Researching the community of inquiry framework: Review, issues, and future directions." 158.

¹⁷ John W. Creswell and David J. Creswell, *Research Design : Qualitative, Quantitative, and Mixed Methods Approaches*, SAGE Publications, Inc. (US), 5th ed. (SAGE, 2018).

¹⁸ Louis Cohen, Lawrence Manion, and Keith Morrison, "Surveys, Longitudinal, Cross-Sectional and Trend Studies," in *Research Methods in Education* (New York: Routledge, 2017), 334–60, <https://doi.org/10.4324/9781315456539-17>.

any significance. Suitable times to collect data were agreed upon with the teachers and the learners. The researchers took turns conducting the interviews to reduce bias.

Data analysis

Corbin and Strauss define data analysis as organising collected data, breaking data, and synthesising it in order to search for patterns so that meaning will be attached to it.¹⁹ This process allowed the researchers to find patterns, links and themes. Tables, graphs and pie charts were used to display the analysed data for easy interpretation and understanding and to enable the reader to develop their comparative narratives.

FINDINGS OF THE STUDY

Questionnaire for the students

Forty learners studying mathematics at advanced level (Form 6) from the selected school were surveyed. All the learners volunteered to participate in the study. The learners completed the questionnaire and each of the question items asked is discussed below.

Did you study mathematics during the COVID-19 lockdown? If so, specify the type of gadget you used?

The learners were asked if they studied mathematics during the lockdown and the type of gadget they used to study mathematics. The results are shown in Fig. 2 below.

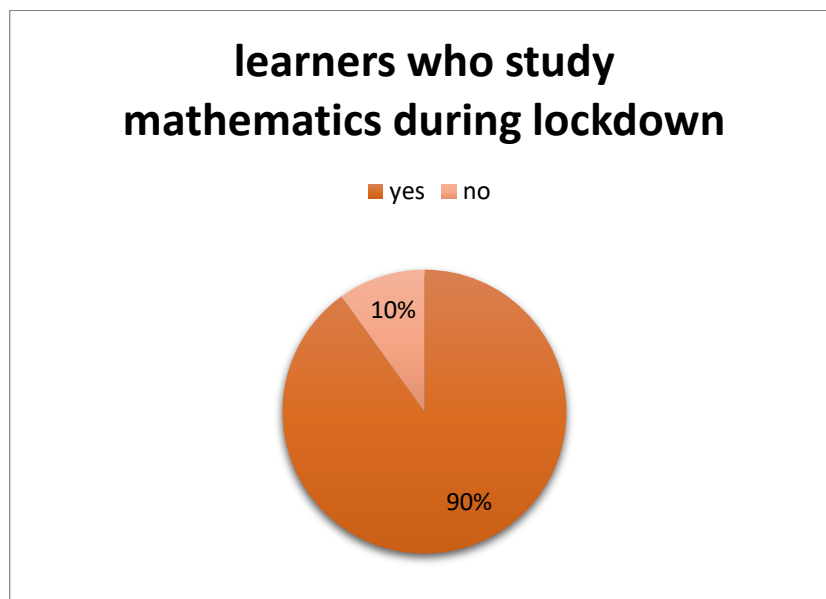


Figure 2: Chart showing students who studied mathematics during the lockdown

It was interesting to note that four (10%) of the learners indicated that they did not study mathematics during the lockdown period, with thirty-six (90%) saying that they studied mathematics. Remarkably, twenty-seven (75%) of students used cell phones as the main device for online learning, with nine (25%) saying that they used laptops/ tablets or cell phones for online learning. All the participants acknowledged that their teacher used the WhatsApp social media platform as the medium for teaching them. This showed that the more interactive methodologies like the use of Zoom, Google

¹⁹ Juliet Corbin and Anselm Strauss, *Basics of Qualitative Research (3rd Ed.): Techniques and Procedures for Developing Grounded Theory* (2455 Teller Road, Thousand Oaks California 91320 United States : SAGE Publications, Inc., 2008), <https://doi.org/10.4135/9781452230153>.

Meet, Microsoft teams and others when not used. This finding agrees with Zinyemba et al. that online learning was mainly for the rich who live in urban areas and that social media WhatsApp was more popular in rural areas.²⁰ However, some of them said that at times they also attended one-on-one extra lessons with some teachers, but this was not allowed at all. They said that at times the police would come and man the area where the lessons were conducted such that the teacher would advise them not to come for the lessons since this was in violation of the COVID-19 regulation. However, as a sign of desperation for meaningful teaching and learning, the one-on-one classes would resume once the police moved to another area. The lessons were conducted in a room at the shopping centre.

What challenges did you face when learning mathematics online?

Most of the students complained that they could not download most of the materials sent by the teachers, including voice notes. They argued that using online learning as a mode of learning is very expensive, even though some of them own smartphones. Some of them said that they encountered some network challenges. It should also be noted that poor network affected the progress of the lessons. One of the learners (L1) said that the place where he lived hardly had any network coverage, so he would go to neighbouring households to access the internet. The student further said that he did not have a cellphone, so he would go to a neighbour's house where he used a tablet owned by a fellow learner who was in a different class. Therefore, at times L1 failed to attend the mathematics lesson if it was scheduled at the time the tablet owner had classes of his own. Another learner (L2) said that he sometimes joined the group late due to poor Wi-Fi connectivity. "It will take much time to open the work and voice notes that our teacher sends," he said. Matimaire and Zinyemba et al. noted that the Zimbabwe government was far from embracing online learning, especially for learners in rural and marginal areas. The learners in these areas did not have the required resources, such as mobile phones. They further noted that the learners experienced challenges such as poor internet connectivity or no connectivity.²¹

L3 and L4 complained that the lessons taught through WhatsApp provided no opportunities for them to interact meaningfully with the teacher or other learners. This was also observed by Kayser and Merz, who, in their study said that in online learning settings, information was presented in such a way that there was no interaction among the learners. In those cases, the lessons are less engaging since learners play a passive role, resulting in loneliness.²²

L5 mentioned that the teacher did not answer some of the questions they posted on the WhatsApp platform. L3 added that another challenge they faced was the disruptions to their study time, as they were expected to do their share of the household chores. This coincides with the conclusion by Terasi et al. that the major difficulties that learners encountered during online studies were that they failed to have quiet places to study, and there were a lot of disruptions caused by the proximity of the locations where the students lived.²³ L3 elaborated that the household chores which included gardening and fetching firewood disturbed them. Barrot et al. further outlined that the learners were affected psychologically because they did not have good learning facilities at home, had no access to the laboratories and did not have the capacity to do fieldwork.²⁴

²⁰ Lizzy Zinyemba, Kundai Nhongo, and Albert Zinyemba, "COVID-19 Induced Online Learning: The Zimbabwean Experience," *African Journal of Social Work* 11, no. 4 (September 29, 2021): 223–30, <https://www.ajol.info/index.php/ajsw/article/view/215261>.

²¹ Kenneth Matimaire, *Digital-Shy Zimbabwe's Schools Feel the Brunt of COVID-19*, 2020, [https://africaninternetrights.org/sites/default/files/Kenneth Matimaire-1.pdf](https://africaninternetrights.org/sites/default/files/Kenneth%20Matimaire-1.pdf); Zinyemba, Nhongo, and Zinyemba, "COVID-19 Induced Online Learning: The Zimbabwean Experience."

²² Ina Kayser and Thomas Merz, "Lone Wolves in Distance Learning?," *International Journal of Mobile and Blended Learning* 12, no. 1 (January 2020): 82–94, <https://doi.org/10.4018/IJMBL.2020010106>.

²³ Marko Teräs et al., "Post-Covid-19 Education and Education Technology 'Solutionism': A Seller's Market," *Postdigital Science and Education* 2, no. 3 (October 13, 2020): 863–78, <https://doi.org/10.1007/s42438-020-00164-x>.

²⁴ Barrot et al., "Students' online learning challenges during the pandemic and how they cope with them." 7321-7338.

How easy was it to understand mathematical concepts taught online?

L1 and L4 stated that they did not understand the work that was sent by the teachers on WhatsApp and mentioned that the work was in the form of notes that were accompanied by voice notes. They further explained that most topics, such as integration and differentiation, could not be understood from the voice notes and the notes given. The learners waited to receive communication from the teacher and worked the problems individually. Therefore, the communication was unidirectional from the teacher to the learners.

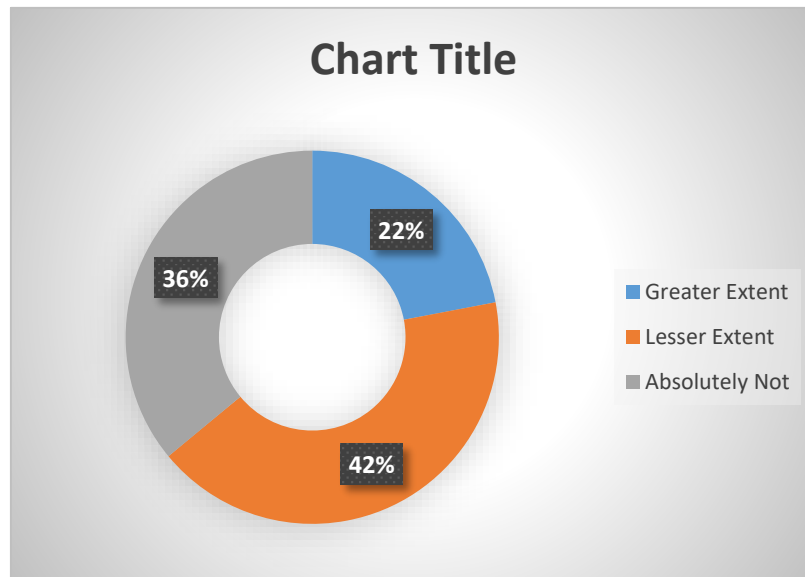


Figure 3. Graph showing the effectiveness of learning online

Figure 3 shows that most learners said that they did not understand concepts taught online. Only eight learners (22 %) said they understood the concepts. A further fifteen (42%) of the students said that they understood the concepts to a lesser extent and thirteen (36%) said they absolutely did not understand the concepts. This does not agree with Khalil et al., who observed online learning to be more convenient than face-to-face instructional strategies.²⁵ However, the findings align with Mahyoob, who asserts that learners shun distance education because of the many obstacles encountered.²⁶

In what ways did parents help you to make online learning effective?

Learners were asked if their parents helped facilitate e-learning and the findings show that the parents made attempts to provide resources that included purchasing data for internet connection. Some parents provided the gadgets such as mobile phones to use during the lessons. In some cases, the family members who owned mobile phones would lend them to the learners, and when these families were away, the learners would not be able to study. L2 and L6 mentioned that their parents bought solar panels and converters to provide the electricity needed to charge the mobile phones used for studying. This showed that the parents were also concerned with their children's education. L4 said,

My parents helped me so much by creating some space in the house so that I get reading space. Wi-Fi was set up basically for my online lessons. My dad

²⁵ Khalil et al., "The Sudden Transition to Synchronized Online Learning during the COVID-19 Pandemic in Saudi Arabia: A Qualitative Study Exploring Medical Students' Perspectives."

²⁶ Mohammad Mahyoob, "Challenges of E-Learning during the COVID-19 Pandemic Experienced by EFL Learners," *Arab World English Journal* 11, no. 4 (December 15, 2020): 351–62, <https://doi.org/10.24093/awej/vol11no4.23>.

emphasised that I must keep working hard and encouraged me set high goals for my future work. He kept on saying that I must be in a position to budget my time wisely and do homework and assignments on time.

In some cases, the learners struggled to access the few resources, such as electricity which all the other people in the household used. L7 said,

I had a hard time with my siblings, who did not give me time to do homework, and we don't have electricity at home. My parents bought a solar panel, but the power is not enough to charge my phone because everyone at home also needs to charge. Even our neighbours come to charge their phones as well.

Some of the learners' responses agreed with Lestiyawati and Widyantoro, who commented that parents played a crucial role in supporting their children during online learning. The parents and family members provided learners with their smartphones.²⁷ However, the support provided was not enough to prove that learning under these conditions was inferior to the traditional face-to-face classrooms.

Findings from teacher interviews

Seven teachers teach mathematics at the school, all of whom were selected for the interviews. The teachers were asked the questions discussed below:

What type of teaching tools did you use for e-learning?

Six teachers said they used WhatsApp for online lessons, and one said that he used WhatsApp and Zoom. The teachers said they sent text messages, and notes with worked mathematics problems that were handwritten or typed and then scanned. They also acknowledged that they sometimes sent voice notes explaining the given notes. One teacher said that he only sent the students some voice notes on the Powerpoint presentation. The teacher agreed that they used WhatsApp because most learners could not afford to buy more data that would allow them to use other tools. T3 said,

I choose to use WhatsApp because it is very cheap. The school is not giving us money to buy the data bundles and we do not have enough laptops at the school, but we need to help these students because no matter what, the exams will be written, and we want to avoid embarrassment when these students fail. Also, at the school, there are a few functional laptops that UNICEF donated and these are reserved for the students who are doing computer science. Also at the school, we are not yet trained to interact with students on various platforms such as Google classrooms, Zoom, and Microsoft Teams and the students we teach are not familiar with the technology. It will be difficult for us to send assignments or give the students feedback. The teacher who teaches computer science was the only one knowledgeable in using computers. Most students have WhatsApp for social purposes, so at least some of them can use it for online lessons.

The teacher here showed that it was not easy for them to facilitate e-learning. The school did not provide them with support because they relied on their own initiatives. The teacher made use of WhatsApp to deliver the lesson. This coincides with the study by Zinyemba et al., which shows that most of the learners in Zimbabwe made use of WhatsApp for social purposes and this provided an opportunity to use the platform for educational purposes.²⁸ Klapproth et al. also noted that the major

²⁷ Rochyani Lestiyawati and A. Widyantoro, "Strategies and Problems Face by Indonesian Teachers in Conducting E-Learning System during COVID-19 Outbreak.," *Journal of Culture, Literature, Linguistics and English Teaching*, 2020, 71–82.

²⁸ Zinyemba, Nhongo and Zinyemba, "COVID-19 induced online learning: the Zimbabwean experience."

barrier to unsuccessful teaching during the COVID-19 pandemic was the lack of adequate computer equipment as well as low internet connectivity.²⁹ T4 said,

I used WhatsApp and Zoom platforms when teaching Form 4A class. Most of the students in my class are offering computer science, so they were familiar with how to use the Zoom platform. Most of them prefer to use the Zoom platform, but surprisingly during the lecture, I noticed that less than half of the class was able to attend, yet those who failed to attend the lesson were crying that they did not have the money to buy the bundles [data for internet connection]. I prepared the Zoom platform because of the hand-raising style and also when I beam my work, I will be able to show the students the key points. I also pre-record the Zoom lessons. The few who attended them also asked and responded to the given questions. However, I also teach using WhatsApp so that I won't disadvantage some of the students who cannot afford to use the Zoom platform, but also very few of the students attended despite that they are advanced level students who are about to graduate from secondary school and now going to university.

Matimairé argued that learners in rural areas in Zimbabwe would not fully embrace online learning because most of them do not have the financial capacity to purchase mobile phones and devices that enable them to access the internet. Though some companies and service providers sell data bundles at subsidized prices, learners in rural areas cannot manage to purchase them.³⁰

What problems did you encounter when conducting the lessons?

The teachers indicated that the major challenge was poor attendance by learners. Some learners might attend the lesson for some time but go offline before the lesson is concluded; few of the students were able to submit their classwork. This is in line with König et al., who say that teachers faced significant challenges in implementing online teaching.³¹ The seven teachers were further probed about their perceptions of the challenges experienced. The responses are illustrated in the bar graph below.

²⁹ Florian Klapproth et al., "Teachers' Experiences of Stress and Their Coping Strategies during COVID-19 Induced Distance Teaching," *Journal of Pedagogical Research* 4, no. 4 (2020): 444–52, <https://doi.org/10.33902/JPR.2020062805>.

³⁰ Matimairé, Digital-shy Zimbabwe's schools feel the brunt of COVID-19.

³¹ Johannes König, Daniela J. Jäger-Biela, and Nina Glutsch, "Adapting to Online Teaching during COVID-19 School Closure: Teacher Education and Teacher Competence Effects among Early Career Teachers in Germany," *European Journal of Teacher Education* 43, no. 4 (August 7, 2020): 608–22, <https://doi.org/10.1080/02619768.2020.1809650>.

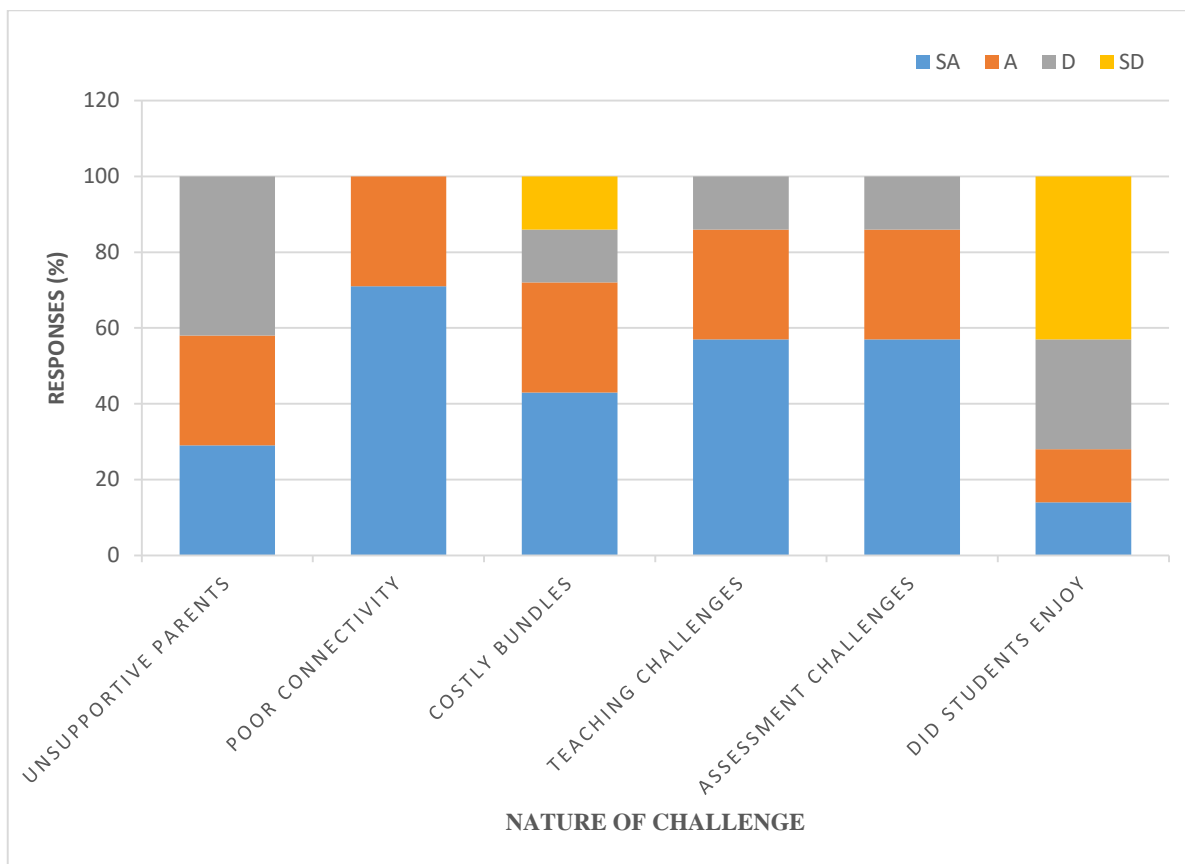


Figure 4. Teachers' responses to the nature of challenges they encounter whilst teaching online

From the graph, one can see that two (29%) of the teachers strongly agreed and two (29%) agreed that the learners' parents were not supportive. However, three (43%) teachers felt that the parents were supportive. However, we noted that the teachers complained of poor network connectivity, with five (71%) strongly agreeing and two (29%) agreeing. They further agreed that buying data for an internet connection was very expensive because 3 (43%) strongly agreed and two (29%) agreed. Only one teacher (14%) strongly disagreed and one (14%) disagreed that the bundles were not costly.

The researchers also noted that four teachers (57%) strongly agreed, and two teachers (29%) agreed that it was difficult to assess learners. One teacher disagreed that assessing the learners was challenging. They noted that this was the computer science teacher who also used Zoom. Five of the teachers (57%) did not agree that the students enjoyed working online.

T4 further said,

Being in the rural area, the main challenge was internet connectivity. You might schedule your lesson at ten, but because of Wi-Fi connectivity or internet problems, it will be difficult to start, and you will have to reschedule the lessons. These disruptions usually occur if there are rains. It takes time for this problem to be rectified.

Terasi et al. and Barrot noted that most students struggle to conduct online lessons because they do not have stable access to any form of internet connectivity and the internet does not have adequate bandwidth to accommodate many people.³² Thus Barrot advocated for the traditional classroom where

³² Teräs et al. "Post-COVID-19 education and education technology 'solutionism': A seller's market."

learners attend face-to-face lessons and further argued that most of the topics taught require that learners conduct hands-on activities.³³ T7 elaborated by saying,

This issue of online lessons gave me a hard time. Firstly, I did not have the proper gadget to use, yet parents in the surrounding area whom I met at the shopping centre complained that I should start these online lessons so that their students won't miss out. Some parents promised to support me with the money to buy the bundles since nothing was coming from the school. Using my cellphone, I noticed that half of the class was attending the lessons, with some logging in and logging out any time and very few parents sent me the money to purchase the bundles. When I made some follow-ups on assignments, most of the students complained that they don't have bundles [data for internet connectivity] and some complained about internet connectivity. When it's lesson time, the students do not give feedback, but after the lesson, the learners greet each other, yet they never say anything during the lesson. Learners failed to share ideas during lessons, and many submitted their work late.

T3 further expounded on the experiences of teaching through WhatsApp by saying,

I used the WhatsApp platform and could send notes and teach many students at once, but I had problems teaching geometrical transformation and loci. This topic required the hands-on and practical use of geometrical instruments, such as a protractor and the compass, when constructing angles and geoboard to illustrate geometrical transformation. This was hard to explain and for students to understand the topic, as evidenced by the students' performance in the written assignments. It was difficult to identify those with problems and to track student progress. I could not set tests but stick to assignments. However, it was better to engage in online teaching than neglect learners and wait for the pandemic to surpass.

T5 described her experiences with online learning as follows,

We had so many challenges, but we also enjoyed them since they helped us to continue teaching rather than just staying home without doing something productive, and I got a few gifts in the form of money and farm produce, to mention a few, from some parents who thanked me for teaching their children during the pandemic. The major drawback was the problem with electricity, and there were some days when there were blackouts.

T2 added to the experiences,

While using WhatsApp as the teaching medium, it was very difficult for me to assess the learners' progress. This was because most of the work that I gave them was mainly assignments and it was difficult to see who had copied when solving mathematical problems. Most of the homework was done well.

The interviews with the teachers showed that they encountered several challenges when facilitating online learning for the first time during the COVID-19 pandemic. However, others acknowledged that though they encountered various obstacles, the good part was that at least some of the learners were benefiting. When schools opened, they had made some progress through remote teaching. The teachers

³³ Barrot et al., "Students' online learning challenges during the pandemic and how they cope with them: The case of the Philippines."

raised concerns that teaching mathematics required the use of interactive tools so that learners could learn effectively. It was difficult for the teachers to use problem-solving techniques and proofs that facilitate learning mathematics with understanding. The teaching style did not promote the reasoning techniques since learners would just download notes and pre-recorded voice notes. These findings resonate with findings in other parts of the world. Klapproth et al. noted that the teachers who used online strategies during the pandemic in Germany experienced technical challenges; however, they persevered. The teachers in this study lamented that the major setback they experienced with online learning was the lack of resources, time, and support from parents.³⁴

What possible measures can be adopted to make online learning more beneficial to learners?

According to Lockee, traditionally, online learning has been regarded as a substitute pathway that adult learners use in higher education.³⁵ However, due to the pandemic, all students across the world, from preschool to universities, embraced forms of distance learning, including online learning. Attard and Holmes argued that the use of and access to technology is viewed as a prerequisite in today's classrooms.³⁶ Despite the identified importance of educational technologies, we noted in this study that access was limited and there was a need to find effective ways to interact and communicate effectively with the learners. The teachers were interviewed so that they could suggest ways to improve online learning in ways that benefit the learners more. The teachers suggested the following strategies based on their perspectives and experiences. T4 said the following,

It is important for the government to create recreational facilities at shopping centres or at schools in rural areas with free Wi-Fi and gadgets that allow learners to access key materials. Furthermore, the government needs to negotiate with the internet service providers for cheaper bundles as well as those who own businesses at the shopping centres to chip in so that students access online learning. The registered school-going students from the surrounding areas should be given priority in using these gadgets and make sure other members of the society are barred because they may vandalise them. It is also important to convince the parents so that they will also pay for the bundles [data for internet connection]. The government must also give teachers and learners cheap bundles through the relevant ministries.

T1 added that the world bodies should also be involved in providing resources for the learners by saying,

The government must approach the donors such as UNICEF so that the teachers should be given tablets to use so that teaching becomes easier. Both teachers and learners must be oriented on how to use these gadgets and things like Google classroom, Zoom, and WhatsApp. Capacity development programmes must look at the issues of eLearning.

Kim argues that many school-going learners do not have the skills necessary to effectively use technology such as typing responses in chat or sharing files and other media, such as pictures and video clips. Therefore there is a need to focus on developing the skills for learning and teaching with

³⁴ Klapproth et al., "Teachers' experiences of stress and their coping strategies during COVID-19 induced distance teaching."

³⁵ Lockee, "Online education in the post-COVID era." 5-6.

³⁶ Catherine Attard and Kathryn Holmes, "An Exploration of Teacher and Student Perceptions of Blended Learning in Four Secondary Mathematics Classrooms," *Mathematics Education Research Journal*, November 10, 2020, 1–22, <https://doi.org/10.1007/s13394-020-00359-2>.

technology for both teachers and learners.³⁷ When teachers use more enabling platforms such as Google classrooms, classes can be effectively managed and lessons are interesting, though due to lack of internet access, teachers advocated for using WhatsApp.³⁸ T7 further expounds by saying that,

It is important to check with parents on children's progress once learning has started and be able to identify the challenges and learning needs and share helpful resources based on those needs. With support from parents and teachers, children's learning and development can continue.

T6 thought that the electricity supply should be improved to ensure a better internet connection by saying,

I recommend that the ministry allow catch-up lessons in school for those left behind, for example, creating learning camps for those lagging behind. Since there are too many blackouts in our country, it is better for schools to have solar panels as well and generators for backup. The communities must be provided with solar panels from donor-funded projects or sold to them for lower prices.

Fraillon et al. noted that many schools were not prepared to use ICT, hence this led to many challenges experienced in implementing online lessons. The training of teachers is one of the identified needs for supporting online learning.³⁹ Although WhatsApp was popular in some contexts, a study by Gibson noted that only a limited number of learners had access to WhatsApp technology.⁴⁰ Li and Che opined that the online modes of instruction in which many challenges experienced were more likely to reduce the academic performance and efficiency of the students.⁴¹ However, Li and Che explain that online learning is more effective when teacher and learner interact through whole-class discussions, cooperative learning and group work are used.⁴²

DISCUSSION

Based on the above analysis, we noted that the teachers in this case study were using WhatsApp platforms for delivering the mathematics lessons, with one teacher saying that he also combined WhatsApp and Zoom platforms. Lestiyanawati and Widyantoro noted that WhatsApp was the most used application to support online learning during the COVID-19 pandemic because it incurred fewer data expenses for communication.⁴³ In using the CoI to analyse the findings of this study, the teaching strategies were limited to sending notes and voice notes.⁴⁴ Therefore, the teaching presence determined

³⁷ Jinyoung Kim, "Learning and Teaching Online During Covid-19: Experiences of Student Teachers in an Early Childhood Education Practicum," *International Journal of Early Childhood* 52, no. 2 (August 30, 2020): 145–58, <https://doi.org/10.1007/s13158-020-00272-6>.

³⁸ Kaukab Abid Azhar and Nayab Iqbal, "Effectiveness of Google Classroom: Teachers Perception," *Prizren Social Science Journal* 2, no. 2 (2018): 1–16.

³⁹ Julian Fraillon et al., *Preparing for Life in a Digital Age* (Cham: Springer International Publishing, 2014), <https://doi.org/10.1007/978-3-319-14222-7>.

⁴⁰ Kerry Gibson, "Bridging the Digital Divide: Reflections on Using WhatsApp Instant Messenger Interviews in Youth Research," *Qualitative Research in Psychology* 19, no. 3 (July 3, 2022): 611–31, <https://doi.org/10.1080/14780887.2020.1751902>.

⁴¹ Junling Li and Wanyu Che, "Challenges and Coping Strategies of Online Learning for College Students in the Context of COVID-19: A Survey of Chinese Universities," *Sustainable Cities and Society* 83 (August 2022): 103958, <https://doi.org/10.1016/j.scs.2022.103958>.

⁴² Li and Che, "Challenges and coping strategies of online learning for college students in the context of COVID-19."

⁴³ Lestiyanawati and Widyantoro, "The strategies and problems faced by Indonesian teachers in conducting e-learning during COVID-19 outbreak," 1-10.

⁴⁴ Garrison and Arbaugh, "Researching the community of inquiry framework: Review, issues, and future directions."

by the inhibiting contextual settings did not promote interactions between the learners and the teacher. The resultant social presence was limited because the learners waited to receive the learning materials so that they could work on them alone. While this study did not go as far as to determine the learners' cognitive presence, the participants felt that learning was not as effective as they wanted. Some learning strategies inherent to mathematics education, such as problem-solving demonstrations and proofs in interactive settings, were not possible. The demonstrations were transferred passively to learners through already worked-out examples and recorded voice notes. Both parties realised they were not interacting as much as they wanted to enable more effective teaching and learning. The study also attempted to devise solutions to challenges experienced by the learners and the teachers based on the teachers' perceptions. There is no doubt that the teachers thought that the issues of access and resources should be addressed if online learning was to be effective. Toquero argues that it is important to take forward what was started during the pandemic in terms of online curriculum implementation.⁴⁵ Sari and Nayir go further to say that there is a need to develop action plans for global crisis situations to manage the education process correctly in an emergency situation.⁴⁶

CONCLUSION AND RECOMMENDATIONS

In this study, the problem-solving strategy to teach mathematics during the COVID-19 pandemic was stifled. The teachers sent already worked-out mathematical examples and voice notes through WhatsApp, resulting in a reduced form of teaching presence compared to the teachers' and learners' prior learning experiences before the COVID-19 pandemic. From the findings of this study, it is recommended that learners and teachers in rural areas should have free Wi-Fi or free internet access and affordable gadgets. The Ministry of Primary and Secondary Education in Zimbabwe needs to prepare electronic materials that are easily accessible to teachers and learners. The teachers should receive professional development on how to improve their teaching presence for better mathematical problem-solving when using social media platforms. Parents are encouraged to play their part in providing resources used in online learning.

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⁴⁵ Cathy Mae Toquero, "Challenges and Opportunities for Higher Education amid the COVID-19 Pandemic: The Philippine Context," *Pedagogical Research* 5, no. 4 (April 16, 2020): em0063, <https://doi.org/10.29333/pr/7947>.

⁴⁶ Tamer Sari and Funda Nayir, "Challenges in Distance Education During the (Covid-19) Pandemic Period," *Qualitative Research in Education* 9, no. 3 (October 28, 2020): 328, <https://doi.org/10.17583/qre.2020.5872>.

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ABOUT AUTHORS

Dr. Lillias Hamufari Natsai Mutambara is currently a Post Doctoral Research Fellow at the University of the Free State, South Africa. She holds a PhD in Mathematics Education. Her research focuses on Mathematics Education.

Dr. Maria Tsakeni is currently a Senior lecturer at the University of the Free State, South Africa. She holds a PhD in Science Education. Her research focuses on STEM instructional and curriculum innovations in schools and preservice teacher preparation programmes.

