Research Article

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Pre-service teachers' WhatsApp preferences in a mathematics methodology course during the COVID-19 pandemic

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Abstract: The study comprised thirteen pre-service teachers who were purposely sampled. Even though there are different online platforms that the pre-service teachers could have used, they all delivered their lessons through WhatsApp because of the several benefits attached to it such as ease and flexibility to use, low cost of WhatsApp bundles, various functions and the fact that it can be used anywhere at any time. The pre-service teachers faced several challenges during peer teaching using WhatsApp such as lack of smartphones, a flood of messages, human interruption, unavailability of electricity and internet and the nature of mathematics concepts. Difficulty in maintaining discipline, assessing learners' progress was also difficult and it was time-consuming to prepare and deliver lessons using WhatsApp. The pre-service teachers suggested that the prices of online devices such as smartphones and WIFI should be subsidized. In addition, they suggested that lessons should be recorded for the learners and that parents should be involved in their children's learning by encouraging them to provide online tools and educating them on online teaching and learning. The study recommends that pre-service teachers need to be trained on the use of online platforms so that they are equipped for any eventuality such as the COVID-19 pandemic.

Keywords: peer teaching; online learning; mathematics; pre-service teacher.

1 Introduction

In Zimbabwe, the education sector was not spared from the effects of the COVID-19 pandemic. It is one of the sectors that was severely affected with all the institutions of learning closed. The lockdown of all education institutions impacted negatively on the learners learning. The face-to-face mode of teaching and learning which used to be widely used in almost all Zimbabwean educational institutions made it even difficult during the COVID-19 lockdown where social distancing is encouraged. With the intention of continuing to provide quality education in higher institutes of learning the minister responsible for higher education encouraged all higher institutions to engage in teaching and learning processes through the use of Information Communication Technology (ICT). For the higher institutions of learning, teaching shifted from the traditional face-to-face teaching in a classroom setup to online teaching. According to Adedoyin and Soykan (2020), online learning involves the use of the internet as well as other essential technologies that help in developing teaching resources for teaching and learning purposes. Online learning is appropriate for social distancing and saving lives. In Zimbabwe, the 2020 academic year of higher institutions was disrupted due to COVID -19 pandemic. The face-to-face mode of teaching and learning for the university under study had begun mid-February 2020 and was suspended just at the end of March 2020. With online teaching, therefore, this meant that all the courses that were initially earmarked for traditional face-to-face instruction were adapted to the online mode of instruction. This article contributes to online teaching and learning of mathematics. The online learning benefits and challenges are presented, followed by the methodology used in the study. The research findings are followed by the discussion, the conclusion and the study's limitations.

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2 Online learning benefits and challenges

In seeking solutions to the COVID- 19 pandemic, the education sector has resorted to online learning as an alternative to the usual face-to-face teaching approaches (Bozkurt & Sharma, 2020; Hodges et al., 2020). Online learning encompasses a number of delivery approaches, learning and pedagogical paradigms, technological-based learning platforms, technological tools and the incorporation of educational technology domains into the learning situations (Papp-Danka, 2014). According to Amelia et al (2020), there are numerous methods that teachers implemented during online teaching and learning that included communication through WhatsApp, provision of learning resources and tasks through Google Classroom and video conferencing using Zoom meeting. Online learning has several benefits, for instance, interactivity, self-pacing and flexibility (Adedoyin & Soykan, 2020; Kim, 2020; Smedley, 2010).

However, the Covid-19 pandemic has brought a lot of challenges through the digital transformation of instructional delivery such as technical, educational, and instructional challenges (Bonsu et al., 2021). Online learning requires technological devices and the internet that makes it a challenge for both educators and learners whose internet is poor (Marpa, 2021). Outdated technological devices are also a challenge as such technologies make it difficult to meet up with mechanical requirements of online learning (Omotayo & Haliru, 2020). Learners and educators whose digital competence is low are likely to lag during online learning (König etal, 2020). Online learning is also associated with a heavy workload especially, where the educators have to transform all the course content to online learning platforms that are user-friendly to the learners (Nsengimana et al, 2021). The heavy workload is also time-consuming and requires financial resources particularly in purchasing tools and the internet (Adedoyin & Soykan, 2020). Online learning results in the nonexistence of face-to-face association amongst learners, learners and educators (Joshi et al., 2020).

There are numerous challenges that teachers experience when using online teaching and learning. In particular, the nature of mathematics makes it difficult to explain using a limited number of words and translation (Amelia, et al, 2020). Even though mathematics as a subject requires intense interaction amongst the teacher and learners, research has shown that teachers simply provide recourse files and close lessons with the assignment, resulting in learners being confused in understanding the mathematics concepts (Amelia, et al, 2020). The unanticipated presence or disturbance of friends, family members and may disrupt the ongoing online lessons (Manfuso, 2020). According to Arkorful and Abaidoo (2015), during online teaching and learning, assessment is usually done online with minimum supervision of learners making it difficult to control and regulate cheating.

The emergence of online teaching and learning has been reinforced by the national lockdown that was enforced due to the COVID 19 pandemic, with the purpose of supporting education with digital teaching and learning tools (Kim, 2020). It is against this background that this study intends to contribute to the ongoing research on online teaching and learning during the COVID 19 pandemic by exploring the forms of online methods that the pre-service teachers preferred to use during peer teaching and the reasons for their choices. In addition, the current study intends to find out the challenges and possible solutions to the challenges that the pre-service teachers faced during their online peer teaching.

The following research questions guide the current study:

1. What forms of online teaching do pre-service teachers prefer and why do they choose such an online method?
2. What challenges did they face when implementing the online method that they selected?
3. What strategies do they consider would improve online teaching that they had used during peer teaching?

3 Research Methodology

3.1 Research design

A qualitative case study design was used in the current study with a small group of pre-service mathematics teachers. According to Merriam and Tisdell (2015), the focus of a case study is on describing the process, specific or cluster activities as well as providing a thorough in-depth explanation and analysis of a distinct bounded entity located in a particular context. The current case study involved an in-depth explanation of the pre-service teachers' choice of online teaching method and related challenges.

3.2 Population and Sample

As part of the DipScED, pre-service teachers take a one-semester applied mathematics methods course that covers aspects of mathematics instructional approaches, teaching, learning and assessment. There were thirteen pre-service teachers in the 2020 cohort. Lectures were held four times per week with each lecture lasting for two hours. The pre-service teachers were required to interpret the national syllabus and design school syllabus as well as designing schemes of work and lesson plans. The pre-service teachers engage in peer teaching intending to put theory into practice. Initially, the course was meant to be delivered through face-to-face with the educators guiding all the classroom activities and discussions. With the COVID -19 pandemic the peer teaching was done online. The adoption of online learning was in agreement with policies of overcoming the spread of the Covid-19 virus as well as maintaining the academic calendar.

The pre-service teachers were asked to choose a mathematics topic that they would want to peer teach. The pre-service teachers had to prepare for the peer teaching through lesson planning and then choose an online method to deliver their lessons. In contrast to methods that dictate the choice of ICT tool for learners to use Albers et al. (2015), in this methodology course pre-service teachers were granted the autonomy to choose the online platform for their peer teaching. They were free to change from one online platform to another throughout the peer teaching depending on the needs of the topic to be taught.

The current study was carried out at a university in Zimbabwe whose mandate is to train secondary school science and mathematics teachers. The population of the study comprised thirteen female pre-service teachers who were in their second year, studying towards a Diploma in Science Education (DipScEd) specialising in mathematics. A convenience sample was used because the researchers used a naturally formed group (Creswell, 2015) of thirteen pre-service teachers. The thirteen pre-service teachers were involved in peer teaching. After peer teaching, the researchers explained to the pre-service teachers their intention to carry out a study on why they chose the online method that they used. After explaining the purpose of the study, the thirteen pre-service teachers volunteered to be interviewed.

3.3 Data collection methods

The data for the current study were gathered through lesson observations and interviews. According to Gorman and Clayton (2005), an observation is a systematic way of recording observable activities or phenomena in a natural situation. Lesson observation reveals the processes of teaching and learning process, discloses the teachers' working conditions as well as the feasibly of providing suggestions for improving the teaching and learning process (O'Sullivan, 2006). Lesson observations may provide answers for the what, how and why research questions (O'Sullivan, 2004). For example, in the current study, through lesson observation researchers can obtain data on what ICT tools are the pre-service teachers using, how they were using the ICT tools and why they were using such ICT tools. In order to collect data, the researchers had to join pre-service teachers' peer teaching groups, this enabled the researchers to observe the lessons in a natural environment as well as seeing what happens during the teaching and learning process rather than depending on oral or transcribed interpretations (Cohen, Manion & Morrison, 2015).

According to Silverman (2016), interviews that make use of digital technology are widely used as data collecting techniques in qualitative research texts. Due to the COVID -19 pandemic, the current study used the WhatsApp instant messaging interviews because of its practical advantages such as the cheap cost of carrying out the study, no need to travel to the interview venue as well as social distancing (Jowett, Peel & Shaw, 2011; Gibbson, 2020). In addition, the researchers opted for WhatsApp instant messaging interviews because all the pre-service teachers had smartphones. The pre-service teachers responded to a set of pre-designed questions to find out their sentiments on online teaching which helped the researchers to understand the pre-service teachers' choices of the online teaching methods and the challenges that they faced during peer teaching. The main questions were: 1. how did they choose the online method that they used? 2. What were the challenges that they faced when using the online method they chose? 3. What strategies do you recommend to overcome such challenges? Interviews were conducted after peer teaching. Each interview lasted for an hour.

Permission to carry out the study was granted by the ethics committee at the university under study. The pre-service teachers were assured of anonymity and that they were allowed to withdraw if they were not comfortable. Informed consent has been obtained from all individuals included in this study. In addition, the pre-

service teachers signed the informed consent form, which was a confirmation that participation in this study was voluntary.

Lincoln and Guba (2011) reiterated that terms such as credibility, transferability and dependability are used to address reliability and validity issues in qualitative research. Member checking was used to determine the credibility of the qualitative data by taking the transcribed data to the pre-service for validation. According to Trochim (2010), transferability is the extent to which the findings from a qualitative study might be generalized to other situations. In this study, transferability was achieved by providing an in-depth description of the population, sample and research context. Triangulation through various approaches of data gathering and sources of information were used to guarantee the trustworthiness of the data (Flick, 2009). Dependability which matches reliability in quantitative research (Trochim, 2010) was achieved through making several operational phases such as the research design, population and research context, selection of participants, data gathering and analysis procedures, validity and reliability issues and ethical considerations were explained in detail to enable readers to establish how the researchers arrived at the research findings and the circumstances under which they were examined.

3.4 Data analysis

Thematic data analysis which involves the utilization of themes (Creswell, 2015) was used in the current study. Thematic analysis is a qualitative technique of analyzing data that involves systematically identifying and describing themes or patterns from qualitative data (Lichtman, 2010). Data from both the observation and interviews were put into themes. The themes were online methods that the pre-service teachers used during peer teaching, the reasons for their choices, the challenges they faced and possible solutions to the challenges. For the purposes of anonymity, each pre-service teacher was identified using a pseudo name. For instance, the pre-service teachers who were interviewed were identified as PS1, PS2, PS3, PS4, up to PS13.

4 Findings

The research results presented below emerged from the analysis of two data sources; namely, observation and interviews. The study investigated the forms of online methods that the pre-service teachers preferred to use during peer teaching, the reasons for their choices, the challenges they faced and possible solutions to the challenges.

4.1 Research question 1: What forms of online teaching tool do pre-service teachers prefer and why do they choose such an online method?

4.1.1 Online teaching tool selected

It was not the intention of this study to focus on only one online method. However, from the lesson observation, it was noted that WhatsApp was the only online platform that was used by all the pre-service teachers during peer teaching. In spite of the various online platforms such as the University Moodle, ZOOM, Google meet, Google classroom, WhatsApp and YouTube that could have been used for peer teaching, it was interesting to note that all the thirteen pre-service teachers used WhatsApp for their peer teaching. The finding concurs with earlier findings by Albers et al (2015) where learners who were doing a project were asked to choose an online method for project based learning communication and they all chose the WhatsApp platform. Before the peer teaching all the thirteen pre-service teachers created a WhatsApp group in which they included the researchers.

The WhatsApp groups were used for communicating with peers and researchers who were the lectures, creating dialogue and encouraging sharing amongst peers as well as a learning platform. From the observations, pre-service teachers used various features of the WhatsApp and were classified as those who use text messages, images and text messages and audio and text messages. All thirteen pre-service teachers used text messages. However, only two pre-service teachers used text messages only to teach mathematics concepts. Figure 1 illustrates how text messages were used by the pre-service teachers.

Another example of the use of text messages is illustrated in Figure 2.

The teachers explained the mathematics concepts through text messages. From the text messages, the learners were asked questions, where they responded using text messages. As shown in the WhatsApp screenshot in Figure 3, the images were supported by text messages. The following are some of the images accompanied by some text messages.

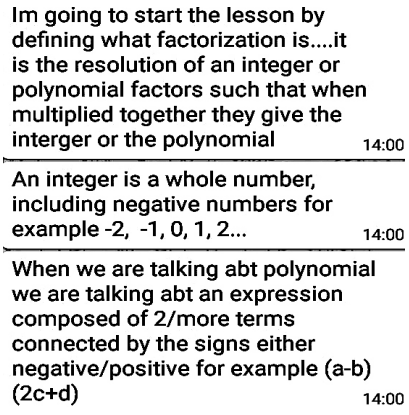

Figure 1: Pre-service teacher's use of text message.

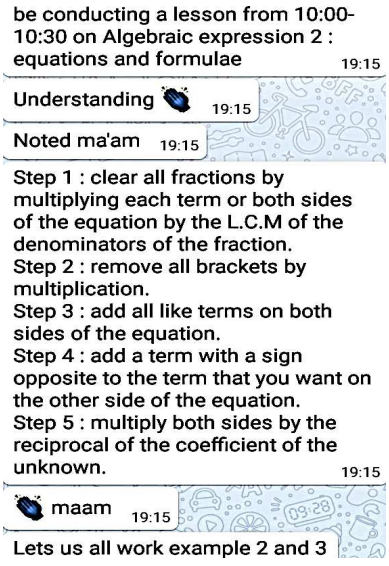

Figure 2: Pre-service teacher's use of text message.

Only one pre-service teacher used a combination of images and text messages to teach concepts on sets. The teacher explained the concepts of the set through images and text messages. Figures 4 and 5 illustrate the pre-service teachers' use of audio and text messages during peer teaching.

Another example of the use of audio and text messages is illustrated in Figure 5.

Ten pre-service teachers used a combination of the image and the audio to teach mathematics concepts. This was widely used by the majority of pre-service teachers. Most of the communication during peer teaching was based on text messages, alongside the use of images and audio options. The use of the video options was almost non-existent. Conflicting to our expectations of the pre-service teachers, whom we thought belonged to the

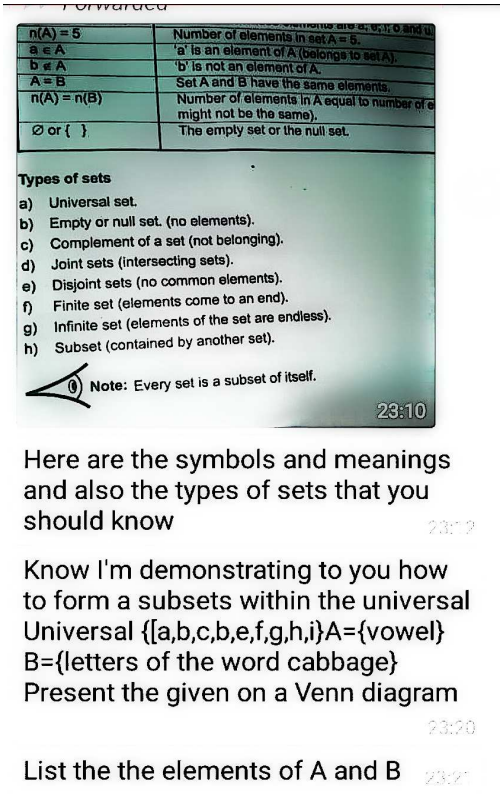

Figure 3: Pre-service teacher's use of images and text messages.

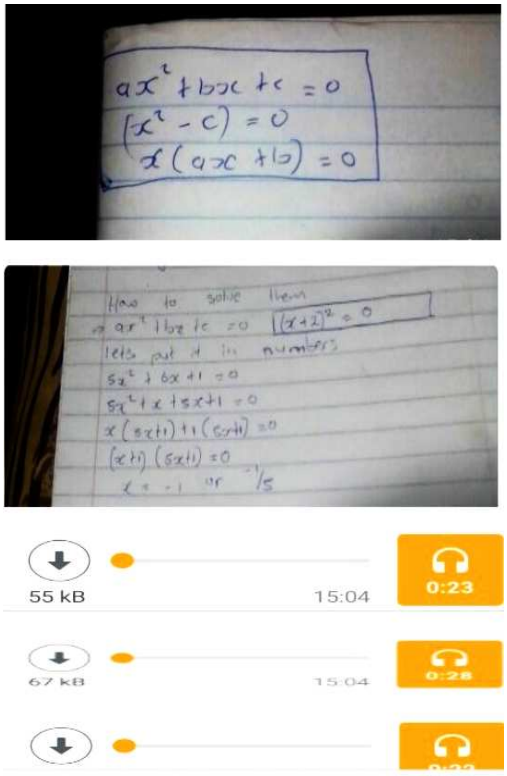

Figure 4: Pre-service teacher's use of audio and text messages.

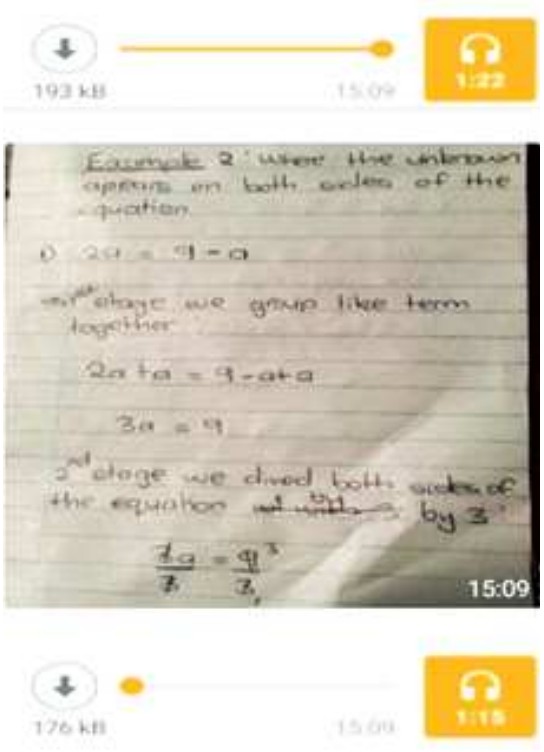

Figure 5: pre-service teacher's use of audio and text messages.

generation of 'digital natives' (Prensky 2001), it did not seem they were able to use various digital platforms as shown by their sole use of WhatsApp only. One reason for this might be that whilst in industrialised countries, educational institutions have ready access to digital tools and internet, the situation is different from developing countries such as Zimbabwe (Zinyemba et al, 2021). Even though the rapid development of technology has enabled the adoption of ICT to support teaching and learning as well as guiding learners to become its diversified users, the pre-service teachers made use of WhatsApp only. ICT tools should first be systematically introduced to learners including their parents before being implemented into the teaching and learning processes (König et al, 2020). The outbreak of the COVID-19 pandemic has just reavealed the consequences of teacher training institutions of failing to adapt to the to ICT transformation process (König et al, 2020). Hence, it is important to provide ICT learning opportunities during training for teachers.

4.1.2 Reasons for choosing the online teaching tool

The pre-service teachers were also asked to explain their choice of the online teaching tool they selected. In this study the pre-service teachers choose the WhatsApp as their online platform. The per-service teachers' reasons for using WhatsApp during peer teaching were classified into three categories: technical, instructional and educational benefits. These categories are discussed in the following sections.

4.1.2.1 Technical benefits of using WhatsApp

All the pre-service teachers had smart phones that enabled them to make use of the WhatsApp. Comments reveal that they used WhatsApp because of its various benefits. The various functions of WhatsApp made the pre-service teachers use it during online mathematics teaching and learning. This is what some of the pre-service teachers said:

> *"I choose this online teaching tool because it has many features that make it easier to deliver a lesson for instance use of group chats feature creates learning and study groups. Audio lessons that can be heard by many at once. It also sends problems or assignments to the learners even if they are not in class". PS1*

> *"It is easy to use, it has voice notes support, video teaching support as well as sending documents files, pdf and slideshows to many at once, and it also allows more effective communication with learners and family at the same time". PS2*

> *"It also enables multi-users when you log in to the lesson on WhatsApp you can also reply to other messages whilst in class". PS3*

> *"It is easy to use unlike zoom platform, google classroom so, the teacher used WhatsApp because all of the learners can use the WhatsApp platform easily. They don't need passwords or email addresses like zoom and other teaching platforms"PS5*

> *WhatsApp platform was easy to use because it is affordable. Many of the learners were not able to attend using other online lectures like zoom etc because they are expensive, but everyone can afford the WhatsApp platform because it is cheap. As a teacher I considered affordability, to do this I used the background of the learners. Some of the learners stay in rural areas, so they do not afford internet and large quantities of data. So WhatsApp platform was the cheapest that every learner can afford". PS6*

> *"It is cheaper than other online teaching tools. Completely free for use". PS8*

> *"It is cheaper to use. More than 50% of the learners are using WhatsApp and almost 95% of the teachers are using WhatsApp as well, so when teachers want to conduct a lesson online, almost every learner will be available and ready to learn online. There will be no need to travel from home to school rather you stay at home and learn from there. This will reduce the costs of traveling fees as well as of accommodation fees. Hence one can say that using online teaching is easy". PS9*

"Firstly I prefer to use it as my special tool for my benefit as well to my learners. I choose it because it is cheap as compared to other tools and it stimulates collaborative work and it achieves the exchange of content both between learners and me". PS10

"It is easy to use for example without typing you can only send voice notes for learners to listen attentively to what the teaching is saying, they can repeat playing it as many times until they understand the concept. Even those who are offline can follow up on your work and can be able to understand the concept". PS11

"The online method that I used is WhatsApp. This method is very cheap to use as compared with other online methods. WhatsApp uses WhatsApp bundles, and they are cheap than data bundles". PS12

It is easy to use and it is used by almost 90% of the learners these days". PS13

The ease of use of WhatsApp enabled the pre-service teachers to universally use it during peer teaching. Pre-service teachers chose WhatsApp as an online teaching and learning tool because they believed it easy to use and also flexible. The pre-service teachers were of the view that WhatsApp is affordable and the WhatsApp bundles are cheap. The use of WhatsApp by the pre-service teachers was on the basis that it is cheap and they could afford it. The findings concur with earlier findings by (Ngalomba, 2020) who pointed out that WhatsApp was easy to use and the data bundles were cheaper as compared to the use of the online platforms.

4.1.2.2 Educational benefits of using WhatsApp

With the smartphones at hand, the pre-service teachers delivered their peer lessons anywhere outside the normal classroom setup and at any time using WhatsApp. This promotes online teaching and learning. Pre-service teachers clarified their choice of WhatsApp as a tool that promotes online teaching and learning as follows:

It also promotes distance learning, l conducted the lesson through WhatsApp such that learners participated, asking and answering questions. Even for those who were offline were they were able to follow up on the lesson". PS 1

"The learners were able to learn mathematics at any time from their homes". PS3

"This method allowed learners to learn from different places at the same time, hence it allows the teaching of mathematics to go on. WhatsApp is the best method to use as compared to other online methods because if a learner fails to attend the lesson due to poor network or lack of data, learners will be able to access the whole lesson when they are back online or when they have data". PS5

"I used WhatsApp because even if the learners miss the lesson they can still go through the messages and learn also like the ones who attended the lesson". PS6

The findings revealed that using WhatsApp enables learners to learn at any time and at any place. The choice of the pre-service teachers' use of WhatsApp as an online teaching tool because they were able to peer teach anywhere and anytime is in line with earlier findings by Bonsu et al (2021) who pointed out that WhatsApp enable teaching to take place anywhere and anytime including during the COVID 19 era.

Pre-service teachers reported that WhatsApp was conducive to peer teaching as they were able to use audio recordings to teach the selected mathematics topics, save the text of discussions and share images and video. This is what some of the pre-service teachers said:

"It allows me to share audio and video lessons so that the learners were able to understand the concept during the lesson. Again there is room for learners to observe what the topic is all about through video and by doing that you are making them become critical thinkers. Furthermore, it helps me to send announcements, notices and information from specific objectives. Therefore, it created appropriate educational content". PS7

"WhatsApp allows the teacher to share the lesson through audio, videos, massaging and photos. During the lesson, learners will be able to ask if they have questions". PS8

"WhatsApp can allow sharing of pictures and audio with learners so, it was the best to use because during the lesson it was going to be easy to give learners content and to explain clearly so that the learners could master the highest common factors. The teacher considered sharing content through the WhatsApp platform. Content can be shared easily for example during the lesson l shared content through audios, pictures and messages. Some of the learners accessed it so easily". PS13

From the findings, WhatsApp has several functions that the pre-service teachers took advantage of. The functions enabled the pre-service teachers to deliver their online lessons during the COVID 19 period as it provides easy accessibility of learning resources which concurs with earlier findings by Bonsu et al (2021).

4.1.2.3 Instructional benefits of using WhatsApp

Among the instructional advantages the pre-service teachers mentioned were the instant sending of messages, messages could be sent to a group of learners as well as giving immediate feedback to learners. Some of the pre-service teachers had this to say:

"Messages are sent instantly, especially when a teacher is conducting a lesson when you are online as soon as you send your messages every learner who is also online will receive those messages it can either be recordings or slides, the best part is everyone who is online will receives those things instantly". PS11

"As a teacher, you can send information to many learners at once especially in a group of many; it can either be a presentation or assignments. For example a teacher of form fours from A up to D, you can make a task for your learners to do but the possible way is to uploads it via WhatsApp to all groups of form forms at once". PS 5

"Communication became easier with my learners because I managed to communicate with them whilst some of them were in remote areas. It motivates learners because they are using the tool they know and they like. There are automatic messages for specific queries in the sense that as a teacher I could attend the messages immediately or easily to see who is online. It also allows easy contact with learners because there is no need to make phone calls or to write a letter, lessons are done there and there. It brings instant messages such that everyone will see what is on the ground. This allows everyone to see the messages no matter where are you. Learners had the opportunity to correct their mistakes immediately".PS13

"It enables the teacher and the learners to use their own learning pace and there is the added flexibility of setting a schedule that fits everyone's agenda. As a result, using WhatsApp allows for a better balance of work and studies so there is no need to give anything up". PS4

WhatsApp has robust features that has allowed its usage to be extended to the teaching and learning of various subjects including mathematics in developing countries, particularly during the COVID-19 era (Bonsu et al, 2021). The findings showed that pre-service teachers were able to share learning materials, access material quickly, and encourage interaction amongst themselves. The findings concur with Bonsu et al (2021) who were of the view that WhatsApp enables the sharing of materials and between learners and teachers. In addition the the WhatsApp platform has a familiar user interface, which makes it esier to navigate by teachers and learners (Mpungose, 2020). This could have prompted all the pre-service teachers to choose the WhatsApp platform that they were familiar with for peer teaching.

4.2 Research question 2: What challenges did they face when implementing the online method that they selected?

Although pre-service teachers managed to deliver their lessons using the WhatsApp, they felt that they were constrained by numerous challenges. The online teaching and learning was imposed overnight due to the COVID 19 pandemic without putting in place the vital resources ICT teaching and learning needed to be possible (König et al, (2020). During the lockdown teaching and learning had to continue through alternative ways such online teaching and learning. Teacher educators and learners had to change to online teaching, which required the use of various ICT tools and materials to solve problems and implement new methods to teaching and learning (Eickelmann and Gerick 2020), which posed so many challenges. The challenges which the pre-service teachers mentioned were categorized into three as technical, educational and instructional challenges. These challenges are discussed in the following sections.

4.2.1 Educational challenges

The nature of mathematics, lack of ICT knowledge, lack of interaction and human interruptions were some of the educational challenges faced by the pre-service teachers during peer teaching. The nature of mathematics poses challenges to the use of WhatsApp when teaching mathematics. Six pre-service teachers had this to say:

"It is difficult to use WhatsApp when doing mathematics. When doing mathematics, for example, solving equations and factorization was difficult to do it online since they are a bit more challenging. To present its working, some of the learners l need to see them working so that if they don't understand they will ask the peer-teacher face to face not through typing or voice recording so that they will be able to grasp the concept". PS1

"I did not manage to illustrate much on the concept using WhatsApp, it was difficult to use it to demonstrate how to solve equations". PS3

"It was difficult for me to explain and present the working of a quadratic equation without face-to-face interaction". PS12

"The most challenge that I faced in my online teaching was that of how to explain and present without face-to-face interaction, when it comes to explaining mathematically the union and complement of sets principles online, I struggled". PS4

"There are some challenges of using WhatsApp teaching and learning in mathematics. It was difficult to explain equations without face-to-face interactions. The best method to teaching equations is the learner-centered method, but when using WhatsApp it was not easy to use the learner-centered method, mostly l used the teacher-centered method". PS5

"As a peer teacher, I noticed that it was difficult to type mathematics symbols because l did not have the software which

allows typing of mathematics symbols on my phone so l had to use pictures instead of typing mathematics symbols. It was difficult to demonstrate and illustrate during the lesson because there was no audio-visual to demonstrate on the board all steps of finding the highest common factors of 42 and 28 and also of 504 and 588". PS6

From the above comments, it can be noted that the pre-service teachers had challenges in teaching mathematics concepts due to their nature. Pre-service teachers had to demonstrate and illustrate the procedures for solving equations to the learners, but when using WhatsApp, it was a challenge. The challenges also emanated from the fact that they had to type mathematical symbols some of the required software that was not installed in the smartphones.

Only one teacher reported that that teachers and learners lacked knowledge on how to use WhatsApp features to teach mathematics. The following response exemplified the lack of knowledge and how to use WhatsApp features to teach mathematics concepts.

"Both teacher and the learners lack knowledge on some features of the use of WhatsApp". PS4

Specifically, the teachers' efforts to employ WhatsApp could not be fulfilled as expected due to a lack of knowledge on the various features of WhatsApp. Teachers' and learners' lack of knowledge on WhatsApp features affected its use in online mathematics teaching and learning. According to Kim (2020) in teacher education training programmes how to teach through online platforms has not been a priority. Nevertheless, due to the COVID-19 pandemic there is need for teacher training institutions to consider training teachers on the use of the various ICT tools including designing suitable methods and practices. The usual traditional delivery of teacher education programs in classrooms might need to be revisited with new methods, new skills and knowledge that teachers might require in the future for them to be able to teach online. Teacher training institutions need focus more comprehensively in the development of skills for teaching with ICT tools in order for the pre-service teachers to be able to use varied ICT tools and be able to find effective methods to interact with, and teach learners online in a similar way that they do in a face-to face situation (Kim, 2020).

Furthermore, although the interaction is important in the teaching and learning of mathematics, one of the pre-service teachers reported that there was no interaction during online teaching and learning. This is what they said:

"There was no class interaction among the peer-teacher and the learners, meaning that I could not have the time to exchange ideas with them". PS3

The finding showed that they could not exchange ideas during online teaching and learning. Two pre-service teachers reported on human interruptions as an impediment to mathematics teaching and learning. The pre-service teachers said:

"It was difficult for me to attend all online lessons and at times l would attend the lessons very late because I will be attending to family issues, such as feeding the young ones as I was learning from home". PS2

"When teaching from home I was disturbed with many things, for example, visitors can come during the lesson and my children were disturbing also, their voices were heard in the audios that I sent to learners". PS5

The pre-service teachers indicated that they had to attend to the needs of the family members including visitors when online learning was in progress. Unlike the traditional classroom where the teacher is physically present and learners are motivated to attend classes and participate in classroom discussions and assignments as well as resolving some learning difficulties, that makes the teaching and learning meaningful and fruitful, online learning has more interruptions than motivators (Olawunmi1 & Osakwe, 2021).

4.2.2 Technical challenges

Insufficient ICT resources, maintaining discipline, time consuming and message flooding were the technical disadvantages mentioned by the pre-service teachers. The responses showed that the pre-service teachers were concerned about the unavailability of electricity and the internet that directly affect online teaching and learning as well as the scanty resources such as money, smartphones and laptops. Pre-service teachers' concerns were supported by the following excerpt:

"Usability is limited by the availability of electricity especially to those who use Wi-Fi. The use of WhatsApp also requires electricity. Unavailability of electricity delay the progress of teaching and learning and even lead to chaotic situations for us as peer teachers". PS1

"Also, some of my learners may attend class lately due to network problems". PS2

"Some of my learners were from those areas with a poor network it disadvantaged them because they did not follow the lesson as expected. Due to poor network, there was a delay of messages such that some of my learners were not able to follow the discussions". PS3

"As the peer-teacher, l was not sure if the network was going to be available when l wanted to conduct the lesson. The network was a major problem, some of the learners did not respond well in time because they had no network. Some of the messages were delivered late. Some learners struggled to download pictures and audios due to poor network. Also, the attendance was poor because of network challenges. There was a shortage of electricity in many parts of the country during the peer teaching period". PS6

"*I noticed that some of the learners did not have adequate resources in the sense that they did not have money to buy either smartphones or laptops. Those learners did not attend the online lessons and at the end of the day they missed out and they will not perform very well in their studies. Some learners had smartphones but could not afford to buy bundles". PS11*

Fruitful online learning requires that learners ought to have access the online environment and the ICT tools used must affordable. Regrettably, most of the learners are unable to do so and are left out from the learning process. The lack of resources such as money, laptops and smartphones mentioned by the pre-service teachers is in line with Olawunmi and Osakwe (2021) who reported that most of the learners do not have laptops, smartphones or even the money to buy Internet data bundles to undergo a three-hour on line course, whilst some of learners live in remote areas where they do not have access to the Internet. Electricity was also mentioned as a challenge to online teaching and learning by the participants. The finding is concurs with Olawunmi and Osakwe (2021) who indicated that online teaching and learning activities needs steady and reliable electricity. In Zimbabwe just like other African countries such as Nigeria, power supply is erratic and unreliable (Olawunmi1 & Osakwe, 2021). Although there are other alternatives such as the generator, it adds an extra cost and not readily available to learners and teachers in the rural areas. The WhatsApp platform is useful for the education sector especially for the teachers and learners in developing countries with unreliable internet and power supply (Ngalomba, 2020) of which Zimbabwe is one of them.

Four pre-service teachers' responses showed that they were of the view that it was difficult to maintain discipline during online teaching and learning using WhatsApp. This is what the teachers said:

"Some learners would go offline or switch off their phones so that there was no communication between the peer-teacher and the learners". PS7

"I felt unsupported because learners were not present during the lesson and some attended late due to network problems". PS8

"I had no control over learners, they joined the lesson as they wish and they easily exited the lesson again. There was nothing that l could do". PS10

"Some of the learners were aware that the lesson was going to start at 10:00, but they showed up towards the end of the lesson". PS6

There was an outcry on maintaining discipline during online teaching using WhatsApp. The learners will join the lesson as they wish and can easily exit the lesson without informing the teacher. Teachers do not have control over who will attend and when would they exit the lesson. Since the WhatsApp platform is free and can be used at liberty, both learners and teachers need self-discipline as well as being more responsible, which might be a challenge (Okeji, & Alex-Nmecha, 2021). In addition there is a tendency to spend more time either planning the online activities or typing the messages or waiting for responses from the learners (Olawunmi1 & Osakwe, 2021). The online line teaching and learning was believed to be time consuming by the three pre-service teachers. This is what they said:

"It takes more time to prepare an online lesson than face to face in the classroom". PS5

"Time-consuming because I had to make sure that each group member understands the concept. I also spend more time typing the messages to the learners". PS6

"*Time was not managed well because of the network, late response and many more. The images and audios took more time to upload and download. During the lesson, the response would come after 2 minutes due to network, of which if it were face-to-face the response just requires a few seconds". PS9*

From the pre-service teachers' responses, time is also a barrier to mathematics online teaching and learning which concurs with (Olawunmi1 & Osakwe, 2021). Only one teacher confessed that she had a flood of messages which was difficult for her to handle. The pre-service teacher commented:

"At times learners asked so many questions at one goal, which made it difficult for me to respond to the messages and at the same time continue with the lesson". PS10

Message flooding as one of the technical disadvantages was noted by a pre-service teacher which was similar to findings by Maphosa et al. (2020) who bemoaned the use of small screen devices which caused in eye strain and message flooding throughout a lecture delivered using WhatsApp. The flood of messages interrupted the lesson as the peer -teacher had to respond to the messages and at the same time deliver the lesson using the same smartphone.

4.2.3 Instructional challenges

During and after the lesson delivery the teachers need to check on the progress of the learners. However, in this study six pre-service teachers were of the view that it was difficult for them to check the learners' mastery of the concepts during online teaching using WhatsApp. They had this to say:

> *"There was a need to check if learners had mastered what l taught them, for example, to check if the learners were able to factorize using the ring number method. But when conducting lessons via WhatsApp, when l give a task to work on, it was difficult for me to see how the learners were tackling the task especially their working". PS1*

> *"It was difficult for me to identify and to help slow learners". PS3*

> *"It was difficult for me to assess the skills and knowledge that the learners had gained at the end of the lesson. When l conducted the lesson, l also wanted to know the extend the learners had understood the concepts on equations, but this was never achieved". PS7*

> *"How to assess learners' knowledge at the end of the lesson was tough for me. There was a need to check if the learners had mastered well the concept of change side change sign method when dealing with equations". PS13*

> *"There are more chances of copying if a task is given online than in a face-to-face situation where the teacher will be monitoring". PS5*

> *"During the lesson l was not able to see step by step of finding the highest common factor done by the learners, to make sure that, they have mastered the concepts. If it was face to face, it was going to be easy because the l would move around and assess the learning". PS6*

The pre-service teachers felt that it was difficult to assess learners' progress during online teaching and learning. In online teaching and learning vital factors during a lecture/lesson such as continuous formative assessment, proximity and eye contact are limited, yet those factors provide an important association amongst the learners and their teachers (Mhindu, 2020). As long as teachers are not able to conduct online formative assessments, it implies that it would be challenging for them to identify learners' needs regarding online learning and to prepare lesson plans adequately for future use (König et al. 2020). Make a diagnosis of the learners' needs and abilities is essential to make proper pre-instructional judgements (König et al. 2020).

4.3 Research question 3: What strategies do they consider would improve online teaching that they had used during peer teaching?

According to Bonsu et al (2021) educational institutions must find various methods of reducing the challenges to WhatsApp or other ICT tools use during the teaching and learning process. Minimising the challenges would enable teachers and learners to adopt the WhatsApp platform and other ICT tools for teaching and learning educational institutions (Bonsu et al, 2021). The possible strategies suggested by the pre-service teachers were classified into as the provision of resources, instructional provisions and embracing technology.

4.3.1 Provision of resources

Pre-service teachers' responses showed that there are possibilities of improving online teaching and learning using the WhatsApp platform. The pre-service teachers suggested that ICT tools, internet electricity be provided to the learners. The pre-service had this to say when asked about ways of improving online mathematics teaching and learning:

> *"The Government must distribute smartphones to poor learners. Distribution of smartphones to the learners who are unable to buy for themselves. This will increase the pass rate of learners because everyone will be able to attend online lessons". PS1*

> *"Reducing the prices of smartphones and laptops". PS5*

> *"Electricity must always be available. Due to the use of Wi-Fi to almost 55% of learners at home electricity must be always available to those learners as well as teachers so that the lesson will be a success. Also, smartphones need to be charged so that they will not be run out of battery for the teachers not to conduct a lesson and for learners not to attend the lesson. This way will improve online teaching and learning". PS1*

"Establishment of good networks in the country and reduction of the price of data bundles so that they are affordable to learners". PS2

"In addition, the provision of a good network system also improves online teaching and learning. For example in towns specifically, when the area crowded the network becomes weak so that no one can be able to send or receive messages through WhatsApp but when the routers are stored everywhere they boost the network. Also in rural areas, people there need a good network for them to increase their education". PS5

"The boosters should be built in every place of Zimbabwe so that learners who live in rural areas can have access to the network. It will be easy for learners who live in rural areas to have a network if the boosters are built in their areas. They will have easy access to the network therefore online learning will be easy". PS6

"Universities should help their learners with data bundles and wifi because some of the learners who stay in rural areas cannot afford to buy data bundles. They can take a part of their fees to cater for the data and wifi". PS7

The pre-service teachers were of the view that learners should be given smartphones whilst prices of smartphones and laptops should be reduced. The use of WhatsApp requires electricity to power smartphones and for the internet. In order to improve online teaching and learning of mathematics, pre-service teachers felt that there should be a provision of electricity to power the ICT tools as well as for the internet. The pre-service teachers were of the view that the internet should be provided in all areas including the rural areas as well as subsidizing the cost of WIFI and data bundles for learners. In addition, the one pre-service teacher was of the view that parents should be engaged in the provision of resources. This is what she said:

"The universities should have meetings with parents, to motivate them to buy devices for their children that promote online learning. Some of the parents do not understand online learning especially those who stay in rural areas. So they need to be taught and motivated on technology issues so that they can support the smooth running of online learning". PS6

Engaging the parents would support online mathematics teaching and learning as they would provide with the resources required as well as educated on the online matters. The support of parents was also mentioned by Kim (2020) not only in the provision of ICT tools but also helping the pre-service teachers in preparing teaching materials so that they include more practical activities in their lessons.

4.3.2 Provision of instructional materials

Pre-service teachers suggested that it was important to record the lessons for future use by their learners. In this category two pre-service teachers highlighted the following:

"The teacher should record lectures. If learners are unwell or struggling with accessing the internet, they will have the recorded lectures. Therefore the teacher should record and send them to learners so that they can watch them in their own time". PS3

"The teacher needs to explain the lesson objectives to learners before the lesson starts learners should be empowered to do the work on their own. Again teachers should record lectures not stream them". PS5

Recording of lessons would enable the learners to learn at their own pace and time. This finding is in line with Mahyoob (2020) who reported that the recording of lessons is one advantage of online teaching and learning which enables learners to access the lessons anytime and may better understand the mathematics concepts.

4.3.3 Embracing technology

One of the pre-service teachers was of the view that both the teachers and the learners need to embrace technology as a way of improving online mathematics teaching and learning. This is what she said:

"Teachers and learners need to adapt quickly to the use of technology". PS4

The findings showed that teachers and learners need to embrace technology, they need to move on with technology in order to improve the online teaching and learning of mathematics.

The findings concur with earlier findings by König et al, (2020) who reported that both teachers and learners should be encouraged and supported in using ICT tools. Teachers and laerner should be committed as well as changing their views towards the 21st century education that is hinged on and is being driven by ICT (Nsengimana et al, 2020) Pre-service teachers must be motivated to get technological competency so that they remain relevant in this digital era besides the pandemics such as COVID 19 (Omotayo & Haliru, 2020).

5 Discussion

The first reserch quetion focused on the the online teaching platform that the pre-service selected. The pre-service teachers used WhatsApp which is supported on Nokia, Blackberry, iPhones and Android windows smartphones (Patel, 2014) and it operates on various current devices and operating systems. The second part of the first research questionfocussed on the reasons for choosing the online teaching platform. WhatsApp works where there is internet connectivity. The pre-service teachers chose to use WhatsApp because they were able to create groups where they taught their lessons using instant messages audio messages, images which are in line with Bouhnik and Deshen (2014) who reported that WhatsApp has various features that can be used for communication. The pre-service teachers were also of the view that WhatsApp was easier and flexible to use during peer teaching. It was easier for them to communicate during peer teaching. This finding concurs with Hodges et al, (2020), Adedoyin and Soykan (2020) and Smedley (2010) in terms of flexibility. In addition, the WhatsApp platform is free, it does not require money to install the App which was also reported by Bouhnik and Deshen (2014). The pre-service teachers also preferred to use WhatsApp because it is cheaper as compared to other platforms and it uses WhatsApp bundles. The finding is in line with Karal et al., (2015) who reported that online learning affords learners with an opportunity to become educated at a lower cost. WhatsApp's easy to use and low cost (Bouhnik & Deshen, 2014; Bonsu et al, 2021), made it a leading choice for the pre-service teachers during peer teaching. Similary, Ali et al. (2020) confirmed that perceived ease of use significantly affects the usage and adoption of WhatsApp for teaching and learning. Pre-service teachers were of the view that WhatsApp promotes online learning as learners would be able to learn at any time from any place. The finding is in line with Bouhnik and Deshen (2014), Oner (2020) and Bonsu et al (2021) who reported that learning can take place at anytime and anywhere. The remaining part of pre-service teachers' 2020 semester learning had to go on through online learning without traditional face-to-face learning (Unger & Meiran, 2020), hence the use of WhatsApp enabled learning continuity during the COVID 19 pandemic.

The second research question was on the challenges they faced during peer teaching. From the findings, the use of images though very good, one of the pre-service teachers confessed to making use of images because of the nature of mathematics that required more typing skills and software. The smartphones did not have such software. According to Keegan (2010), WhatsApp does not support the use of mathematical symbols and formulae. In line with such a finding, Castro, Pino-Fan, Lugo-Armenta, Toro & Retamal (2020) observed that not all smartphones are compatible with current learning platforms, they do not support approaches that are essential for the teaching procedures. According to Castro, et al., (2020), none of the available ICT resources respond to learning requirements caused by the COVID-19 pandemic.

Although WhatsApp had various functions such as audio, text messages and images that could facilitate interaction, one pre-service teacher felt that interaction was minimum. The finding showed that it was difficult to attain adequate interaction using WhatsApp. The finding is in line with MacLaren (2014) and Kim (2020) who reported that technological tools are not sufficient to guarantee interaction as well as an effective teaching and learning process of mathematics on online teaching.

The study also revealed that the pre-service teachers had challenges in explaining mathematics concepts using WhatsApp. The finding confirms earlier findings by Karal et al., (2015) who stated that teachers had problems in explaining mathematics concepts when using online teaching and learning tools. Displaying mathematics concepts, problems, as well as procedures and steps of solving problems and teacher-learner interaction, have a huge effect on the learning outcomes (Karal et al., 2015). Internet connectivity was mentioned as a challenge to online teaching and learning. Some of the lessons were discontinued due to internet connectivity. The findings confirm earlier results by Marpa (2021) on internet connectivity as a challenge to online teaching and learning.

The pre-service teachers reported that it was difficult for teachers to maintain discipline when teaching online. According to Castro, et al., (2020) management of the learning process during online teaching and learning is complex, hence learning should not be considered as the responsibility of teachers only. The findings also showed that it was time-consuming to prepare as well as teaching online. This finding is in line with Adedoyin and Soykan (2020) and Marpa (2020) who stated that one of the drawbacks of online teaching and learning is that it is time-consuming. Regardless of several online teaching and learning challenges, Ngalomba (2020) was of the idea that the education sector must constantly evolve in order to cope with the instantaneous growth of digital technologies. Educational institutions must have learnt from the unanticipated effects of the Covid-19 pandemic on education, hence the need to make use such a disaster to remind them to have a contingency strategy in place

(Ngalomba, 2020) in the event of similar pandemic occurring in future.

The last question focussed on the posible solutions to the challenges emnating from online teaching and learning. The findings showed that the pre-service teachers were of the idea that learners from poor backgrounds should be provided with ICT tools required for online learning. The finding is in line with Barr and Miller (2013) who reported that learners should be supported with ICT devices. In addition, the pre-service teachers suggested that lessons should be recorded which is in line with earlier findings by Barr and Miller (2013). Parents must take a leading role in their children's learning (Castro, et al., 2020). The pre-service teachers were of the view that parents should be involved in their children's learning by encouraging them to support online learning as well as educating them on online learning. This study provided vital information on pre-service teachers' choice, use and challenges of using ICT tools such as WhatsApp that was selected for peer teaching by all the pre-service teachers. The findings helped to explain WhatsApp's actual use, benefits and challenges in using WhatsApp for teaching and learning during the COVID-19 pandemic. It can be conculded that for pre-service teachers to successfully learn with ICT tools such as the WhatsApp during the COVID 19 pandemic, there is need to provide platforms that are easy to use, useful, and free from technological challenges. In addition, WhatsApp enabled teaching and learning to go beyond the classroom's borders which is encouraged due to the COVID 19 pandemic.

6 Conclusion

It was not the purpose of this study to investigate the use of WhatsApp during pre-service teachers' peer teaching in the COVID-19 era, however, during the peer teaching observation, it was noted that all the pre-service teachers opted for WhatsApp as an online teaching and learning platform. WhatsApp which is an Internet-based ICT tool that enabled both the teacher and the learner to send and receive messages in a multiplicity of media presentations, such as documents, text, pictures, voice or video calls and videos was used by the pre-service teachers during peer teaching. In the current WhatsApp was useful during peer teaching because it enabled, the pre-service teachers to post, share content and engage in online discussions anywhere and anytime. The cost of the WhatsApp bundles was also another factor that pre-service teachers considered when choosing an online platform to use.

However, challenges such as insufficient resources, human interruption, maintaining discipline, time-consuming, flood of messages, lack of knowledge on some of the WhatsApp features and unavailability of electricity and internet. The pre-service teachers suggested that the government should provide smartphones to disadvantaged learners. In addition, electricity and network should always be available so that learning is not disrupted. Pre-service teachers were of the view that learning institutions should assist learners with Wifi for their studies. Both teachers and learners must embrace technology especially in this COVID-19 era where WHO is advocating for social distancing and online teaching and learning is the only solution to this pandemic. It was also suggested that teachers should record the lesson notes and activities for the learners. It is crucial to engage the parents in their children's learning by encouraging them to contribute to online learning through the provision of ICT tools and the internet as well as educating them on online teaching and learning. It is recommended that the government and learning institutions should subsidize ICT tools and the internet for the learners to enable online teaching and learning. Even though Cheng and Chau, (2016) have emphasized that learners must be given the flexibility to select a desired online platform, there was a need to integrate other online platforms during peer teaching. The study, therefore recommend that pre-service teachers should be trained on how to make use of other online platforms such as ZOOM and Google classroom. Using WhatsApp as online teaching and learning platform requires pedagogically wise and comprehensive learning approaches including the integration of appropriate tools depending on the given tasks. Since online assessment has being proved to be challenging due to high chances of cheating, it important for to develop online assessment platforms where learners could not cheat for future use in the event of such pandemics. (Bozkurt & Sharma, 2020).

Generally, the results of this study showed that there is an opportunity of harnessing ICT tools to make sure that teaching and learning processes are not interrupted during the Covid-19 pandemic, particularly for teachers and learners in developing countries such as Zimbabwe where there is unreliable internet and power supply which is in line with Ngalomba (2020). WhatsApp and its various features enabled pre-service teachers to proceed with peer teaching even during the lockdown.

7 Limitation of study

Even though the findings of the current study cannot be generalized to other pre-service teachers due to the small sample size, they are useful in providing understandings for practices and strategies online teaching methods and challenges.

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