

Information and Communications Technology in Engineering Graphics and Design Classrooms: A post COVID-19 era

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Abstract

The integration of information and communications technology in teaching and learning is growing at an exponential rate due to many factors we have observed lately, such as the outbreak of COVID-19. The unprecedented outbreak of COVID-19 took the world by surprise. Many sectors such as health and education were left shattered due to the outbreak of COVID-19. The outbreak compelled the educational sector to come up with alternative majors to keep the teaching and learning process alive as the physical classes were suspended as means to curb the spread of COVID-19. In an attempt to investigate different ways Engineering Graphics and Design teachers used to conduct lessons during the COVID-19 lockdown, this study employed a qualitative approach. Data was collected through semi-structured interviews and analysed using thematic analysis. The findings of this study indicate that COVID-19 did influence the way teachers are teaching post-COVID-19. The study findings further reveal that WhatsApp was the tool most teachers relied on to keep teaching and learning alive, however, some teachers were experiencing problems. The study recommends that teachers should continue using WhatsApp as a way of extending lessons during home hours.

Keywords: COVID-19; EGD; ICT; WhatsApp; Virtual learning

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INTRODUCTION

The integration of information and communication technology (ICT) is not something that is new; it is something that has been talked about on many media platforms as well. In one of the media platforms that South Africa has, the president, Cyril Ramaphosa, announced that in the next six years, schools are going digital (Matiwane, 2019). The writing is on the wall, especially since the outbreak of COVID-19, but the question is, are teachers ready for this challenge? The unprecedented outbreak of COVID-19 has accelerated the need to infuse ICT into teaching and learning. Furthermore, COVID-19 came with a lot of changes in the educational sector, like moving from physical classes to online classes and the adoption of ICT as a tool to supplement the traditional teaching approach. This sentiment is shared by Van der Spoel et al. (2020), who assert that COVID-19 has indeed compelled teachers to transform their styles of teaching from the traditional to the modern, which entails the integration of ICT. The effects of COVID-19 in education were further articulated by Khoza (2021), who said that COVID-19 compelled the Member of the Executive

Council (MEC) of education to introduce the paperless classroom initiative as a way of salvaging education from the pandemic. The paperless classroom, also known as the "virtual classroom," is a platform that teachers can use to integrate ICT into teaching and learning without being physically present in the classroom. As much as this is a great idea in an attempt to move with the times, the integration of ICT into the teaching and learning of Engineering Graphics and Design (EGD) subjects is a concept that requires teachers to have a high level of ICT skills (Mndzebele, 2013). However, it seems that because of their practical nature, teaching subjects like EGD, which require the ability to visualise or perceive a graphic, may be difficult to teach online. Unlike other academic subjects, those requiring practical, hands-on learning appear to have several obstacles to overcome in online settings. As articulated by UNESCO (2011), the shift in the delivery of lessons with a strong practical component such as EGD raises fundamental questions about teachers' abilities to deliver practical-based teaching. Mndzebele (2013) posits that teachers are the ones who should be at the forefront of employing the use of ICT in teaching and learning, so the question is whether teachers are equipped with relevant skills and ready to infuse ICT in EGD lessons. This is more like driving a car, and to be able to do so, you must have relevant driving skills. This notion is the same as the integration of ICT into teaching and learning, especially for subjects like EGD, which will require teachers to be capacitated with relevant ICT skills. Consequently, this study aimed at responding to this phenomenon.

Research Questions

This study was guided by the main research question: What impact did ICT have in teaching and learning of EGD during COVID-19? The main research question was supported by the following sub-research questions:

1. What platforms were used by EGD teachers during COVID-19 lockdown to conduct classes?
2. To what extent did COVID-19 affect the way EGD lessons are being conducted now?

Literature Review

Virtual Learning as a Tool of Infusing ICT

Social distancing has become the norm since lockdown was implemented more than a year ago (Nordling, 2020). Schools were no exception as they were also expected to practise social distancing, so virtual learning (VL) came into the picture, and for the VL to be implemented successfully, teachers needed to have technological skills. According to Schlosser and Simonson (2006), "virtual learning" refers to a classroom environment that functions effectively without or with little traditional teaching. Another definition for VL or e-learning is that it comes in many forms, such as using WhatsApp, Zoom, or Microsoft Teams for the purpose of teaching and learning. A study by Li and Lalani (2020) reveals that e-learning has changed education dramatically in the sense that the level of retention for learners has increased, but Higgins (2014) claims that ICT combined with VL would not guarantee good results. However, Bernardes and Oliveira (2021) argue that the process of adapting and implementing remote teaching for EGD has changed the idea that it is not possible to deal with a subject of this nature online. But it looks like most teachers, inclusive of EGD are still resistant to integrating ICT in their classrooms. However, Li and Lalani

(2020) further argue that it is not all rosy about VL, as teachers are frustrated about the fact that some learners have unreliable internet access while others are struggling with the actual virtual learning and electricity outages. Figure 1 shows an example of how a class conduct on Microsoft looks like.

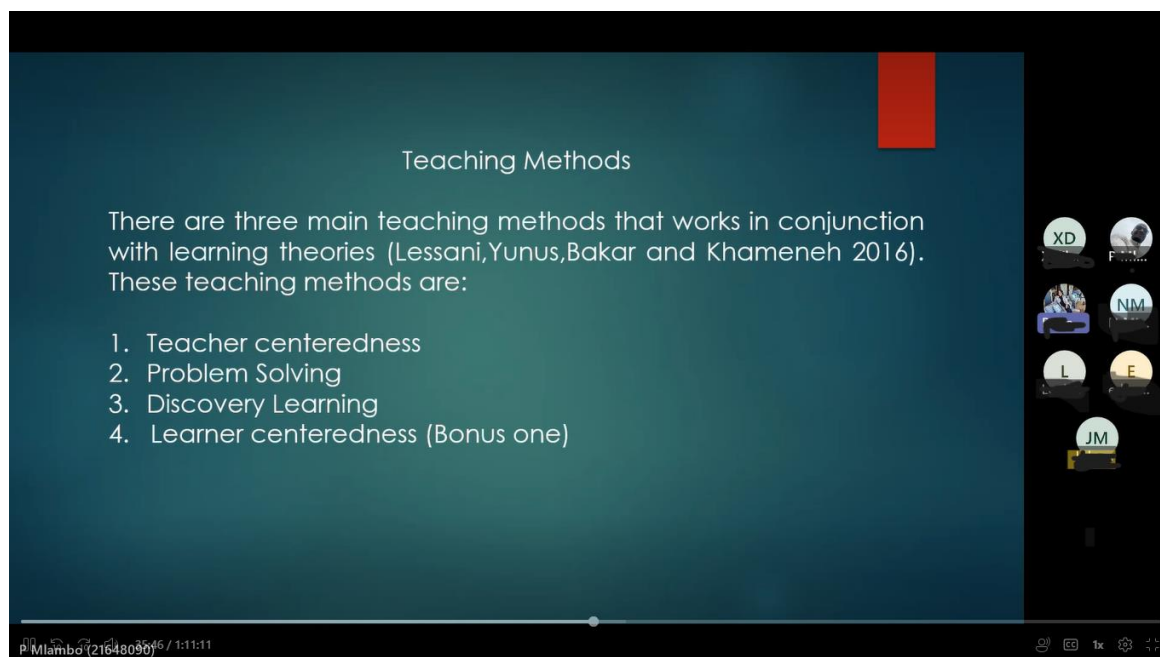


Figure 1. Online lesson on Microsoft Teams

Figure 1 shows the class that took place on Microsoft Teams post COVID-19. This figure shows one of the virtual platforms that teachers used during COVID-19 to conduct VL as physical classes were at a halt to try and mitigate the spread of the virus. In these trying times, teachers can adopt VL as a way of replacing traditional teaching pedagogy (Bloom et al., 2020). However, for them to utilise VL, they must be ICT-capable. This means that teachers must be equipped with ICT skills so that they can integrate ICT into the classroom via VL. A study by Mashile (2017) shows that many educators are having problems keeping up with the technology and digital demands of the school environment, which brings concerns as the time we are living in forces us to go digital. In contrast, Yuen et al. (2003) posit that the use of ICT in the past decade has increased enormously. Generally, in schools around uMgungundlovu district, the integration of ICT in other subjects is increasing, but it remains unclear as to whether the same principle applies in the teaching of EGD considering its complexities. Since most youths are digitally savvy and own a gadget or two, the adoption of VL would bring excitement into learning, and maybe even classroom attendance would grow. Prieto and Velasco (2010) conducted a study to investigate how to improve spatial skills in drawing classes and showed that learners performed better in drawing subjects supported with visual and virtual materials rather than printed materials. Trucano (2005), posits that the integration of ICT in teaching and learning can increase learners' autonomy and the retention rate since they would be learning with things, they are familiar with. For example, in the cams section and the assemble drawings section, most of the things their learners are not familiar with are technological, so using technology can work to their advantage. This is an indication that ICT integration in the teaching and learning of EGD leaves much to be desired by both teachers and learners.

WhatsApp in Teaching and Learning

In the entire universe, VL is a broader subject that has to do with conducting classes through virtual or online platforms. This term became prevalent in the education sector during the nationwide lockdown that came due to the outbreak of COVID 19, as educational sectors tried to come up with alternative ways to supplement physical classes. Physical teaching and learning became impossible, and educational institutions resorted to distance learning platforms (Li and Lalani, 2020). According to Li and Lalani (2020), teachers used WhatsApp, Zoom, and Microsoft Teams to conduct online classes as physical classes were no longer possible. Li and Lalani (2020) further mentioned that other teachers had opted for Google Classroom. "WhatsApp is a free messenger application that works across multiple platforms like iPhone and Android phones, and this application is being widely used among learners to send multimedia messages like photos, videos, and audios along with simple text messages" (Gon and Rawekar, 2017). According to Asmara (2020), this is the tool some teachers used to send videos and documents to their learners for the purpose of learning. This is an indication that WhatsApp is playing an important role in teaching virtually. In support of this assertion, Gon and Rawekar (2017) came up with a list of advantages of using WhatsApp as a learning tool (LT) in the study they conducted. These advantages included: easy use, a teacher who is always available to respond to queries, and the ability to receive learning documents very easily. These advantages are an indication of why many teachers prefer to use WhatsApp for teaching. In EGD, teachers can easily use WhatsApp to send videos to learners that expand on what was taught in class. WhatsApp has been proven to be very important in facilitating classes online, and it gained prominence during the COVID-19 lockdown. It has been of great benefit to the educational sector ever since. According to Bere (2012), the benefits of using WhatsApp as a LT are (1) multimedia: allows users to share videos, text messages, images, and voice memos; (2) group chat: it supports interaction of up to 50 group members; (3) unlimited messaging: there is no limit to the number of messages you can exchange on WhatsApp; and (4) offline messaging: messages are automatically saved when the device is offline.

However, Gon and Rawekar (2017) further mentioned that not all is rosy with WhatsApp, as some teachers did experience problems while using the app. This is the sentiment that was echoed by Asmara (2020) as cited by Li and Lalani (2020), that slow internet connections or no internet connections at all, electricity outages, and not having phones at all were the obstacles teachers were faced with. Table 1 below, by Gon and Rawekar (2017), highlights other challenges that teachers and learners were faced with in using WhatsApp as a LT (Table 1).

Table 1. Challenges of using WhatsApp as teaching learning tool

| S.NO | Advantages/ Subcategories | Strongly Agree (%) | Agree (%) | Neutral (%) | Disagree (%) | Strongly Disagree (%) |
|------------------|------------------------------|-----------------------|------------|-------------|-----------------|--------------------------|
| TECHNICAL | | | | | | |
| 1 | No smart phone | 38 (59.23) | 14 (27.98) | - | 6 (8.20) | 2 (4.59) |
| | Message flooding | 36 (57.16) | 9 (16.07) | 5 (10.16) | 3 (4.92) | 7 (11.69) |
| | Time consuming | 29 (54.54) | 14 (15.74) | - | 5 (11.26) | 12 (18.47) |
| | Group maintenance | 23 (34.15) | 8 (14.37) | 14 (23.66) | 1 (2.73) | 14 (25.08) |
| | Eye strain | 31 (52.79) | 11 (15.74) | 5 (5.68) | 5 (14.37) | 8 (11.42) |

| S.NO | Advantages/ Subcategories | Strongly Agree (%) | Agree (%) | Neutral (%) | Disagree (%) | Strongly Disagree (%) |
|----------------------|--|-----------------------|------------|-------------|-----------------|--------------------------|
| EDUCATIONAL | | | | | | |
| 2 | High expectations of teacher's availability | 31 (43.11) | 9 (17.98) | 5 (10.93) | 4 (8.96) | 11 (19.02) |
| | Huge amount of learning material makes it confusing | 20 (40.87) | 18 (24.97) | 7 (11.04) | 7 (7.38) | 8 (15.74) |
| | Use of inappropriate language | 3 (4.64) | 4 (9.18) | 2 (1.80) | 4 (6.45) | 47 (77.92) |
| INSTRUCTIONAL | | | | | | |
| 3 | No efforts by some students | 35 (63.17) | 8 (11.80) | 3 (5.30) | 7 (9.67) | 7 (10.05) |
| | Some students share material to impress facilitator without actually learning about it | 34 (57.65) | 14 (21.97) | 4 (7.43) | 2 (2.73) | 6 (10.22) |

Table 1 above shows the findings based on the study conducted by Gon and Rawekar (2017) about the challenges most learners and teachers encountered when using WhatsApp during the COVID-19 lockdown. Being on lockdown meant that physical classes were no longer possible, and as a result, virtual classes were the only way to go. This presented teachers with an opportunity to try other modes of conducting classes, and some discovered WhatsApp as a great platform to conduct classes away from school premises. However, such an idea did not work out for the best for some other teachers, as they experienced problems related to WhatsApp. Based on findings by Gon and Rawekar (2017), as expressed in Table 1 above, some learners had no smartphones that supported WhatsApp, while other teachers reported that some learners did not put much effort into engaging in the lesson, and another challenge was that it consumed much time.

As much as WhatsApp promised to be the best way teachers could conduct virtual classes, that was not the case. Another challenge that was faced by many teachers was load shedding. According to Malik et al. (2022), load shedding is the temporary interruption of electricity for a certain period of time due to a greater demand for electricity than supply. The interruption of electric power also affects the network, which leads to teachers and learners not being able to use WhatsApp as it needs the internet (network) to operate. The issue of load shedding is further attested to by Siddiquah and Salim (2017) who report that most teachers reported load shedding as some of the challenges they encountered during COVID-19 lockdown that hindered the process of teaching and learning. Furthermore, Siddiquah and Salim (2017) cite that the second-largest challenge faced by teachers and learners was the non-availability of ICT resources at home. This is because not even a single person was expecting COVID-19; as a result, it took everyone by surprise, hence no provisions were put in place to conduct lessons away from home. All the above-mentioned challenges, which hindered EGD teachers from successfully conducting classes during

lockdown, have necessitated the need to investigate the level of readiness of EGD teachers towards the integration of ICT into teaching and learning.

Availability of Resources in Schools

A study done by Mathevula and Uwizeyimana (2014) that there was a shortage of ICT resources in schools in a study that was conducted in 2014. Much as the data presented in the above figure is 8 years old, the possibility that little has changed due to the ailing economy of the country in the past 10 years is evident. Some ICT resources are regarded as the minimum requirement for any school that wants to integrate ICT into the teaching and learning of EGD. These resources are an IWB, AutoCAD, and a projector. The lack of ICT infrastructure in schools is further revealed in the findings of the study conducted by Alharbi (2021), which revealed that one of the barriers teachers are faced with in integrating ICT is a lack of resources. The issue of a lack of ICT resources is not only experienced by teachers in South Africa but all over the globe. This assertion is backed by Addandani (2011), as he cites that schools in Saudi Arabia also experience a lack of ICT resources, which hinder the successful integration of ICT. So, this is the global challenge when it comes to integrating ICT into teaching and learning. The same can be said for the schools around uMgungundlovu district that offer EGD, as the lack of ICT resources has been found to be inadequate. Alharbi (2021) further cites that the lack of resources also includes a lack of educational software. Put simply, it means that teachers are put at a disadvantage when there is no educational software at their disposal. This is to say computers might be available, but the lack of educational software and the internet can hinder teachers greatly (Alharbi, 2021). This further raises the role played by the educational software. The most used software in EGD for the purpose of simplifying abstract concepts is AutoCAD. Figure 2 shows an interface of AutoCAD 2024 during a lesson.

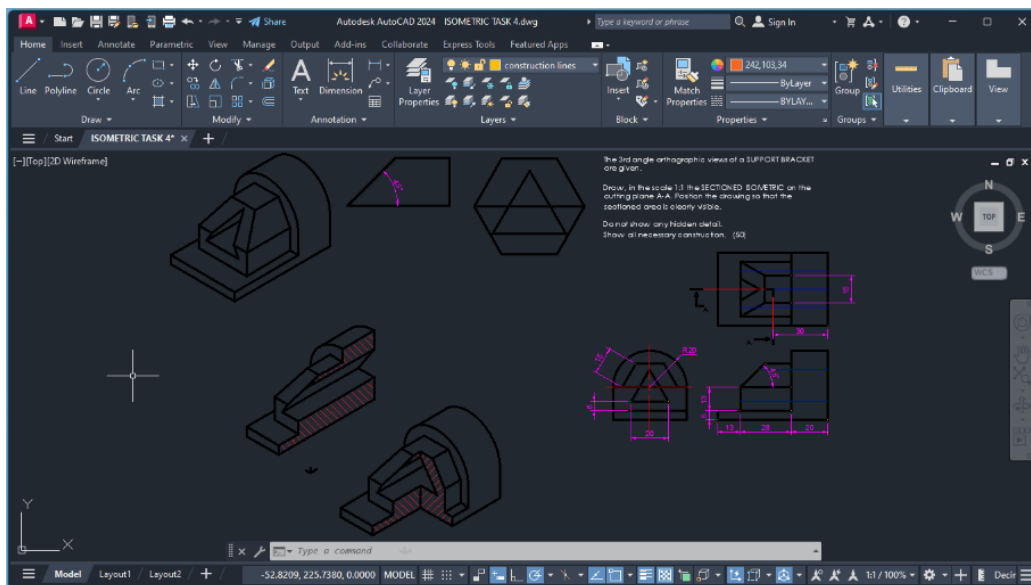


Figure 2. Isometric drawing lesson on AutoCAD 2024

Figure 2 shows an Isometric lesson that took place in an EGD. If most schools could have access to the AutoCAD software that could assist learners understand some concepts better which are not taught well using the traditional approach. This is mainly because AutoCAD has been proving to be able to bring abstract concepts to life.

Teaching and Learning Post COVID-19

The unprecedented outbreak of COVID-19 left a permanent mark in the educational sector which is made up of basic education and higher education. It is no secret that teachers resorted to emergency remote teaching which was seen as a temporally solution (Assunção Flores and Gago, 2020). However, due to the effect COVID-19 had on teaching and learning, teachers were compelled to adopt the 'emergency remote teaching' as a full-time solution to guard against any form of ambush that might pose a threat to education again. Another reason teachers continued using ICT even after COVID-19 has died down is the advancement of artificial intelligence (AI) which threatens to take over the world. In support of the aforementioned statement Mhlanga (2023), asserts that AI has made significant strides in recent years and these strides impact the education sector. These are some of the reasons which have compelled teachers to continue using ICT to conduct lessons. This is an indication that the status quo hasn't change in as far as teaching and learning is concerned. Teachers are continuing to use online conference platforms such as Zoom, Microsoft teams, Skype and even WhatsApp to extend lessons to home. COVID-19 led them to use different virtual platforms to continue to be in contact with their learners (Almonacid-Fierro et al., 2021). In the same vein, "Use of the synchronous video conference resource via Zoom, Google Meet, to carry out Physical Education classes and course meetings ... realization of information capsules on the subject of Physical Education for all grades, delivery of information and practical guides through the WhatsApp application, Messenger, among others." (Almonacid-Fierro et al., 2021). This is the effect that COVID-19 left in education which is still being practised after the pandemic has passed. Figures 3 and Figures 4 show how classes were conducted pre and post COVID-19.

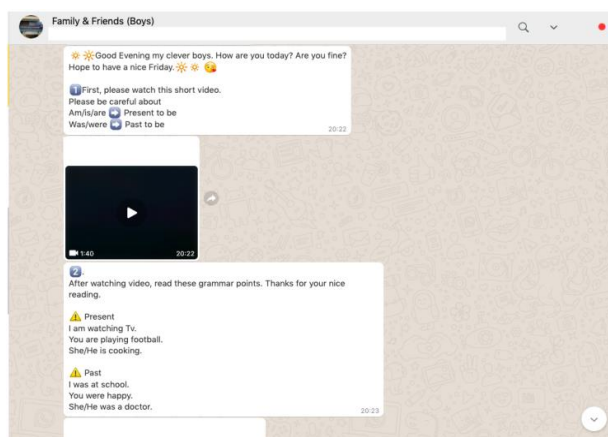


Figure 3. Online class during COVID-19 (Khatoony and Nezhadmehr, 2020)

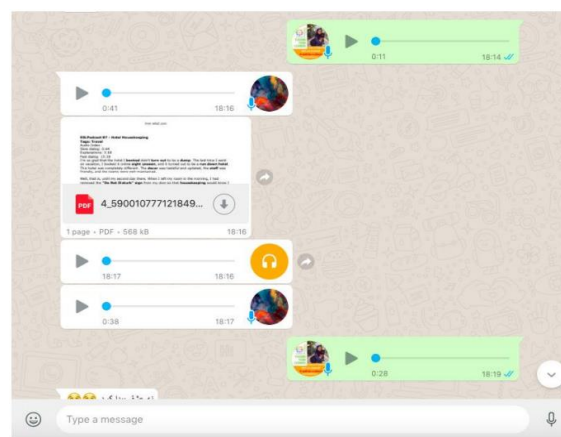


Figure 4. Classes post COVID-19 (Khatoony and Nezhadmehr, 2020)

The figure 3 shows how lessons were conducted during COVID-19 and this is exactly how classes are still conducted currently as shown in figure 4. This shows how COVID-19 influenced teachers to continue conducting lessons the way they did during COVID-19. This signals the influence COVID-19 brought in teaching and learning. In both figures WhatsApp was used as the platform to conduct classes pre and post COVID-19. This is in line with the findings of a study by Almonacid-Fierro et al. (2021) which revealed that due to the pandemic teachers resorted to using different virtual platforms to conduct classes such as WhatsApp and Zoom. Furthermore, teachers have continued to get in virtual learning because COVID-19

trained them to use technology in teaching and learning as result even after COVID-19 they couldn't stop because they possess relevant technological skills and they see the impact technology has in teaching and learning. The same assertion is echoed a study conducted by Winter et al. (2021) who said: "Most respondents report that recent changes to education caused by Covid-19 have increased their use of technology". To further emphasize the reasons why teachers continued to use technology after COVID-19, below are responses from a study done by (Tuia and Esera, 2023).

"I was happy with technology because it helped me to continue teaching students during the Covid-19 lockdown. Most of us have had exposure to some of these online techniques, but the pandemic ensured that was put into good use and was productive for teachers and students as well"- participant 2

"Technology saved us from schools closing because everyone was lost, especially with the unexpectedness of it [lockdown], as once word got around, government moved to close its borders including schools. There was little preparation time, but [school] administrators and management were quick to respond to provide online support. Students and teachers were able to continue their education and kept up to date with classes and assessment"- participant 4

Above are some of the responses from the participants in study done by Tuia and Esera (2023) which are an indication that technology played a significant role in teaching during COVID-19 as a result teachers continued to use technology post COVID-19.

METHOD

This study employed a qualitative research approach and data was collected through semi-structured interviews. In the context of this study, semi-structured interviews were used to gain a deeper insight into the matter at hand through one-on-one sessions with the participants. Semi-structured interviews were used because of their ability to get first-hand information from the participants. According to Creswell (2007), as cited by Raman and Yamat (2014), semi-structured interviews are preferred because of their ability to elicit insights toward understanding a phenomenon. The interviews took place in EGD teachers' classrooms with each interview lasted about 12-15 minutes. 9 EGD teachers were interviewed. Data was analysed using a thematic analysis. According to Caulfield (2019), creating themes is a way of analysing qualitative data. Caulfield (2019) further mentions that, when creating themes, a researcher examines the data to identify common trends and patterns.

This study was situated in Pietermaritzburg under uMgungundlovu District in KwaZulu Natal. Out of 11 schools offering EGD as a subject in uMsunduzi Circuit, this study used 9 EGD teachers from 9 different schools who were conveniently sampled. It is worth noting that EGD is a very scarce subject that not every school has; hence, this study used the available EGD teachers as the sample for this study. And that explains why other schools were not selected for the study. Besides, the schools were also chosen because of their accessibility and proximity to the researcher. It is worth noting that the researchers had intended to use all 11 schools in the uMgungundlovu district offering the subject EGD, but only 9 schools responded positively to participating in the study. Hence, only 9 teachers from 9 schools were selected as respondents.

According to Taherdoost (2016), convenience sampling involves selecting participants because they are readily and easily available. This sampling method was used because it is very cheap and helps overcome many limitations that a researcher can stumble upon. In the same vein, the advantages of using convenience sampling are that it consumes the least time and is the most convenient and least expensive (Taherdoost 2016). Convenience sampling was employed because there were no other criteria in place beyond the willingness and availability of respondents. With convenience, you do not struggle to get participants because the nature of this sampling is to take those who are readily available, which makes it easier to use than other sampling techniques. Another reason behind employing convenience sampling is the geographical proximity of EGD teachers, so using convenience narrowed it down to teachers who are close to the researcher, which again saves time and proves to be more economical (Etikan et al., 2016).

RESULTS AND DISCUSSION

Semi-structured interview findings

First question posed was about the different ways teachers were using to conduct lessons during the COVID-19 lockdown. Below are how teachers responded:

Teacher I said:

"We used WhatsApp, we created a WhatsApp group. So, I communicate with them via WhatsApp. We have been using it before COVID-19, so when COVID-19 came it gave us more time to communicate using technology. I recorded the lessons and sent them on WhatsApp".

In addition to what is indicated above, Teacher H from School H said:

"We tried to give them work over WhatsApp where you can just send videos or pictures so that they can see what you are trying to teach them."

Teacher B from School B also confirmed that WhatsApp was the only way she used to conduct classes during lockdown:

"I created a WhatsApp group and I was sending information like maybe this week can you read your books from this page to that page and try to do those activities that are there. I remember isometric drawing in grade 12 2020 I asked them to draw it and take a picture and send it back to me."

Teacher G said the following after he had been asked how he was conducting classes during lockdown:

"We used video calls through WhatsApp and I also recorded myself and send it to them".

Similarly, teacher A from School A said:

"With the Grade 12's we had a WhatsApp group that we used. WhatsApp group assisted us especially with the PAT, as it had to be done at home because learners weren't allowed to come to school so that how we managed to have some lessons. Only WhatsApp."

Teacher F said this when asked about conducting classes during the COVID-19 lockdown:

"There was no communication except using WhatsApp."

The same sentiment was echoed by Teacher F:

"We used WhatsApp. It was basically voice recordings on WhatsApp".

Teacher G said:

"We used video calls through WhatsApp and then I also recorded myself and send it to the learners but the problem with that, was that some children did not have smartphones".

Similarity, Teacher E from School E said:

"I did not conduct any classes because learners did not have cell phones and others did not have data. In a class of 40 learners maybe two learners had cell phones and they did not have data so we could not do anything"

The same sentiment was echoed by Teacher F:

"There was no communication except using WhatsApp and other did not have phones".

Teacher I had the following to say:

"For learners that had problems with data I requested them that they must use their parent's phones so that they can access, or they can go to one place as a group in one home that had access to WIFI so that they can all get the lesson".

From the above responses, only two themes emerged. Theme 1: Classes were conducted through WhatsApp. Theme 2: No classes were conducted during COVID-19 lockdown.

THEME 1: Classes were conducted through WhatsApp

In terms of conducting classes during the COVID-19 lockdown, most teachers indicated that they relied heavily on using WhatsApp to ensure that the process of teaching and learning was kept alive. Reliance on WhatsApp during the COVID-19 lockdown was mentioned by EGD teachers. This is an indication that EGD teachers did conduct classes during the lockdown, and they did that through social platforms such as WhatsApp. And it proved useful in ensuring that the process of teaching and learning was continued even in times of trying in the educational sector as physical classes were suspended. WhatsApp proved to be a crucial tool in conducting classes. This is backed up by Alenazi (2018), who reported that integrating WhatsApp into education produced desired learning and social benefits. The same sentiment was echoed by Asmara (2020), who said WhatsApp is a tool that was used by teachers to support the process of teaching and learning during the COVID-19 pandemic. However, not all teachers had the luxury of using WhatsApp, as others encountered problems in trying to use WhatsApp as a tool to keep classes alive during COVID-19 lockdown. The majority of teachers indicated that they did conduct classes during the COVID-19 lockdown, and they did that through WhatsApp.

THEME 2: No classes were conducted during COVID-19 lockdown

This shows that as much as most teachers managed to successfully conduct classes through WhatsApp, the same cannot be said for other teachers, as they encountered challenges when trying to use WhatsApp. The challenges of using WhatsApp for educational purposes are common. In support of this notion, Gon and Rawekar (2017) posit that there were many challenges that arose from using

WhatsApp in teaching and learning. Asmara (2020) further mentioned that learners experienced problems such as not having a good internet connection and supported headphones. Those challenges include the availability of smartphones, being inundated with messages, not having a data or internet connection, and constantly focusing on the phone screen, which causes eye muscle fatigue. Challenges associated with VL were further mentioned by Li and Lalani (2020), who cited that slow internet connections, electricity outages, and not having phones or laptops were considered challenges by teachers and learners.

Another question posed was about the influence COVID-19 has had on the way they are conducting class or if they are still teaching the same way they did before COVID-19. Below is how they responded:

Teacher A from School A said the following when asked about the influence COVID-19 had:

"I would say after COVID-19 everything changed. It is no longer like before. As of now we are still using that WhatsApp we created during lockdown. COVID-19 did influence the way I'm teaching now."

Teacher B had the following to say:

"Yes. It influenced a lot because there were learners who were doing grade 11 grade 10 in 2020, they were affected by COVID-19 and there were so many things they did not do, so many chapters they did not do. So, we are now trying to cover all the gaps in a short period of time".

In a same vein, Teacher G said:

"Yeah, COVID-19 changed the way we teach, because we saw that WhatsApp can make things easier for children when they are at home. So, we continued to use video calls and voice recordings even after school hours. COVID-19 did influence the way I'm teaching now."

Teacher I said:

"I think COVID-19 opened the window of using technology and the importance of knowing more and of learning more using technology. Before COVID-19 we thought that everything was ok the absence of classes and the absence of learners made us to realise that we need to use something. A tool that which we can use to convey information to learners and continue with teaching and learning. So, it did, it was like an eye opener. It taught us that we are in a technological world."

Similarly, Teacher H said the following:

"Changes are there. We had to think of ways of preparing worksheets way in advance for the entire year in a form of a booklet. We are now proactive we prepare work way in advance so that whatever happens they have something. It opened our eyes that we need to prepare worksheets in advance. Yes, it did we are proactive now."

Teacher D, in answering the question that was asked, said:

"The only challenge is time because some chapters were not done, and we are now trying to fill those gaps. COVID-19 did change the way we are teaching now."

From the above responses, only one theme emerged. Theme: COVID-19 has changed the way teachers are teaching.

THEME 3: COVID-19 changed the way teachers are teaching

With the above assertions from the teachers, it shows that COVID-19 really changed how things are done. The changes brought by COVID-19 to the educational system were echoed by Van der Spoel et al. (2020), who posit that COVID-19 compelled teachers to transform their teaching methods from traditional to online lessons. Furthermore, according to Khoza (2021), the effect COVID-19 had on our educational system compelled the MEC of education to introduce what is called the "paperless classroom" to ensure that technology was integrated into teaching and learning. This was seen as a major measure being put in place to counter changes that were enforced upon us by the COVID-19 pandemic. In a nutshell, COVID-19 did influence the way teachers are teaching now.

Another question that was posed was about the challenges teachers experienced when using technology. Below is how they responded:

Teacher B responded like this:

"It's important and I cannot say I have a challenge in using them, it's just that I do not have the correct equipment for example a projector. Here in school, we do not have a projector, I have to buy it and a projector is very expensive".

In addition to what is said above, Teacher F had the following to say:

"As I have been saying in our school, we have got lot of subjects that are being offered so sometimes if I prepare a lesson and I wish to use a particular type of technology and the other teacher wants to use it as well. In this school, it is a big school but there are only two projectors for the whole school. Only a photocopier that I have access to anytime."

Teacher G, when asked, said:

"The computer that we have here at school doesn't have AutoCAD. We do not have smartboards; we do not have a whiteboard we only have a chalkboard."

Teacher F said:

"The laptop I use is mine. I use my own because here in school there were break ins and the laptops that were provided by DoE were stolen."

"The main challenge. The thing that poses as a challenge is the electricity, when you find that there is load shedding, so your lesson is ruined. If the school had funds, we would use solar panels to provide electricity so that our lessons would not be impaired. We do have material but without electricity we cannot use them."

Teacher A said:

"The challenge we have in this school is that we do not have a computer lab where we can use AutoCAD and learners can also use AutoCAD for PAT purposes".

Teacher G had the following to say:

"In terms of AutoCAD, it is still a challenge because we know how to use AutoCAD, but you cannot put it in any computer. The computer that we have here at school does not support AutoCAD."

Similarity, Teacher E said:

"With AutoCAD it is still a challenge for me. I need to be trained because I do not know how to draw using a computer, so it is a big challenge for me."

In a same vein, Teacher D said:

"We do have a computer lab, the only thing we do not have is a license for the AutoCAD."

From the above responses, only one theme emerged. Theme: Lack of availability of ICT resources in schools.

THEME 4: Lack of availability of ICT resources in schools

Several teachers indicated that the challenge they are most facing is the lack of availability of ICT resources in schools. They claim that they understand the importance of infusing technology, but they do not have the resources to use for the purpose of teaching and learning. This sentiment is shared by Munje and Jita (2020), as the findings of their study revealed that schools do not have adequate resources to infuse ICT. This was further echoed by Ghavifekr et al. (2016), who said that the greatest challenge in schools is the insufficient provision of computer resources, which prevents the integration of technology in the classroom. According to Alharbi (2021), there are a host of challenges that teachers come across every day when trying to infuse ICT into teaching and learning. One of those challenges is the lack of provision for educational software. On the contrary, some teachers mentioned that the department did provide the school with resources, but there were other challenges that proved to hinder them. This is echoed by one of the participants in the Munje and Jita (2020) study, who said, *"The DBE had provided the school with computers, but due to theft, these were no longer available."* This is an indication that DBE is making provisions so that teachers can infuse ICT into teaching and learning. Teachers and learners encountered many challenges when trying to utilise video as a tool to infuse ICT. According to Li and Lalani (2020), those challenges included but were not limited to slow internet connections and electricity outages, to mention a few. These statements from the teachers are indicating that in schools there is a lack of availability of resources.

CONCLUSION

The main objective of this study was to investigate the effect COVID-19 had in teaching and learning of EGD and to monitor the life post COVID-19. The findings show that most EGD teachers relied heavily on using WhatsApp as a teaching platform during the COVID-19 lockdown. However, the findings further revealed that some teachers were not able to conduct classes through WhatsApp due to challenges encountered such as loadshedding which brings issues with network and learners not having smartphones. The findings of this study also revealed that COVID-19 did influence the way they are teaching post COVID-19. COVID-19 compelled them to integrate ICT into teaching so that they will not be found wanting again when another unprecedented pandemic strikes. The study established that integrating technology is the best way to go however the findings of this study indicate that there is a lack of availability of resources which may hinder the successful integration of ICT into EGD classes. Based on the aforementioned findings of the study it is clear that COVID-19 compelled EGD teachers to adopt WhatsApp as a teaching and learning platform with an aim to keep teaching and learning alive.

RECOMMENDATION

The study recommends that WhatsApp must be used as it is regarded as a useful tool that must be used as means of extending school hours at home. The study further

recommends that Department of Basic Education should provide schools with resources such as projectors and AutoCAD so that EGD teachers can be able to integrate ICT into teaching and learning of EGD. This is recommended so that teachers cannot be found wanting in the near future as they did during COVID-19.

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Conflict of interests

The authors declare no conflict of interest.

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