

Analysis Of The Use Of Digital Platforms By University And College Lecturers In Instruction Of Mathematics During Covid-19 Pandemic Era

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Abstract

COVID-19 pandemic has affected educational systems throughout the globe, which has resulted in the total shutdown of learning institutions. Particularly in Uganda, the education sector shutdown has had an impact not only on students and parents but as well, on instructors in these institutions. This has called for an increase in the intensity of integrating online tools and resources in teaching and learning mathematics in teacher training institutions in Uganda an inevitable transition. This paper presents research that focused on 45 mathematics lecturers' experiences in using digital platforms in instruction in the era of the COVID-19 pandemic. The research was conducted in three secondary school teacher training institutions in Western Uganda. To ensure the scientific validity of the study, SPSS edition 23 was used to examine the tool for coherence, and it produced a reliability coefficient of 0.786. To obtain the descriptive statistic, data was also analyzed using the Statistical Package for Social Sciences (SPSS) version 23. The outcomes demonstrate the participants' experiences with the problems and benefits of utilizing digital platforms. According to the findings of this study, before integrating digital platforms in mathematics instruction, both lecturers and students should be allowed to learn and interact jointly via digital platforms. It was also recommended that virtual libraries and online databases should be made publicly available at any time and free of charge, offering an additional level of support to address mathematics teaching and learning difficulties.

Keywords: COVID-19, Digital platforms, ICT tools, Instruction, Mathematics
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Introduction

Coronavirus disease (COVID-19) is an airborne disease caused by an infection known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Malla et al., 2020). COVID-19 is a significant public health concern because of the potential risk of large outbreaks it has caused globally. The disease has been shown to cause significant morbidity and is potentially fatal, especially if it is untreated or prevented (Zhong et al., 2020). Uganda confirmed the first case of COVID-19 on 21 March 2020 and since then cases have been on the rise (Ministry of Health Uganda, 2020). Consequently, the government immediately introduced a policy of social distancing as one of the appropriate preventive measures to stop the spread of the virus while ensuring critical services remained available. This preventive measure came at an extremely significant expense as schools, universities, colleges, and other high concentration points were shut inconclusively to curb the spread of the virus (Ministry of Health Uganda, 2020).

All educational institutions in Uganda are guided and run by defined calendars (Ministry of Education and Sports, 2020), and therefore the Ministry had to think about alternative approaches to teaching and online teaching has been adopted as the means to continue engaging learners during the shutdown of the education sector. However, the success of this practice depends on how instructors are prepared to utilize ICT tools in instruction. Learning with ICT tools requires uploading learning materials such as modules, assignments, and tests on the institution's websites so that they can be easily accessed by learners. However, the implementation of such systems requires the lecturer's readiness to integrate ICT tools into their instructional practices. ICT integration practices should be considered as pedagogy to cover the HEI's curriculum. No recent research has been conducted in Uganda to assess how lecturers are coping up with this type of instruction.

According to Hattie, (2003), lecturers' instructional practices are the most important factors that directly impact the learning outcome of the learners. Mathematics teaching practices employed by lecturers who frequently integrate ICT in their instruction have the most positive impact on the learning outcome of the learner. Higher institutions of learning in Uganda are replacing the traditional instructional practices of teaching and learning mathematics with online instructional practices. However, this new paradigm shift brought about by COVID-19 poses challenges of whether both lecturers and students are ready for the takeoff.

A good number of mathematics lecturers have been caught incognizant as their institutions have authoritatively mandated them to utilize online ICT resources to avail learning materials to their students yet; some of these lecturers do not have the simple fundamentals of computer applications like the Microsoft office package. The low level of ICT skills and abilities consequently exposes lecturers to paramount ICT innovations challenges in utilizing ICT in mathematics instruction. Nevertheless, the challenges emerge as a result of the lecturer's readiness status and confidence to integrate ICT tools in pedagogy (Yulisman, 2017). Regardless of the attempts of the Ministry of

education to integrate ICT into Uganda's education curriculum, the system remains characterized by the traditional chalk and talk learning approach with very limited scope for the application of concepts, and yet the current global education challenges require access to modern technology platforms to keep pace with learning and teaching in the 21st century (Crossley & McNamara, 2016). This paper will therefore analyze the use of digital platforms by University and college lecturers in teacher training institutions in the instruction of Mathematics in Uganda during the Covid-19 Pandemic Lockdown.

Objectives

Because of the pandemic's significant global crisis, most educators were compelled to adopt online instruction, in which they had to employ digital technologies for the first time for the majority of the educators in the context of Uganda, to aid their students' learning. As a result of the COVID-19 pandemic school closures, significant technological developments have occurred, with far-reaching implications. We already know that educational disparities have widened, and learners have experienced more social and emotional imbalances (OECD, 2020). Families have been more interested in their children's schooling as a result of this (Engzell et al., 2021). The objective of this research is to analyze the use of digital platforms in mathematics instruction by lecturers in selected secondary school teacher training institutions in western Uganda during the Covid-19 outbreak. The study intends to find out which ICT applications lecturers utilized the most and how they used them in mathematics instruction during the COVID-19 pandemic lockdown. Lecturers' challenges in integrating ICT tools into mathematics lessons and their solutions were also explored.

Literature Review

In the era of COVID-19 pandemic, various schools, colleges, and other higher education establishments in many countries around the world, particularly Uganda, adopted eLearning by utilizing the available ICT technologies in the instruction of mathematics (Olum et al., 2020). A study by Naidoo, (2020), investigated the perceptions of South African postgraduate mathematics students studying using digital platforms for learning. According to his results, digital platforms give unrestricted access to course content and materials. The results also reported that the technology tools are costly and that they require training to properly use the digital platforms. As a result, lecturers must be trained in the usage of digital technologies as well as their advantages and uses. When lecturers are competent, they are more inclined to utilize digital technologies for teaching, and if digital equipment is provided, training is required to promote appropriate and effective use in the classroom.

Numerous studies (Grand-Clement et al., 2017; Pozo et al., 2021) have sought to explain how the online revolution has affected educational contexts, as well as how this revolution is transforming mathematics instruction. Technology integration in mathematics instruction benefits teaching and

learning while also improving students' performance (Mlotshwa & Chigona, 2018). Nevertheless, lack of technical skills has a detrimental impact on mathematics lecturers' usage of technology-based instruction in the context of Uganda. As a result, some lecturers of mathematics are resistant to accepting and changing their teaching practices to integrate technology into their courses (Ezumah, 2020). Moreover, there are indeed a plethora of internet mathematics instructional websites, as well as a variety of digital applications, that can have an impact on students' understanding, and achievement (Amer & Alnaja, 2017). It is thought that the use of digital technologies for education can enhance students' achievement in mathematics (Sung et al., 2016). Moreover, if digital technology, tools, and resources are used appropriately, they can increase the pace and depth of mathematical instruction.

The integration of digital platforms in mathematics instruction in higher institutions of learning helps the learners by piquing their attention, which has a favorable impact on students' achievement (Handayanto et al., 2018). Furthermore, the adoption of digital platforms in the instruction of mathematics brings about improved students' conceptual understanding (Naidoo, 2020). Additionally, both strong and underperforming mathematics learners can gain through the utilization of online ICT resources, since the integration of digital platforms in mathematics instruction has been linked to increased student improved performance (Sung et al., 2016). However, raising learner attainment occurs when lecturers can determine how digitized tools and technologies can be leveraged to create enhanced learning and instructional outcomes, in addition to having knowledge and comprehension of the technology.

Notwithstanding, the integration of digital platforms in mathematics instruction supports the formation of support networks among professional learning communities (Mlotshwa & Chigona, 2018). Yet, the effectiveness of adopting these digital platforms is partly dependent on the effectiveness of the digital tools, but also on the time provided to complete certain assignments within the course program (Sahal & Ozdemir, 2020). Furthermore, integrating digital technologies in mathematics instruction might cause students to get frequently sidetracked, resulting in them not finishing their assignments on time (De' et al., 2020; Mbukusa, 2018). As a result, it is the lecturer's choice to use a digital platform that suits his instructional pedagogy in supporting students' learning. Therefore, the lecturer must facilitate educational advancement, especially the use of digital platforms to enhance pedagogy in mathematics education in the present COVID-19 pandemic period (Kang, 2021).

The digital platforms currently being utilized by the participating institutions are Zoom, WhatsApp, Moodle, Google Meet, Microsoft Teams, and e-mail. Because of the pervasiveness of digital platforms and the simplicity with which they are utilized in everyday life, disallowing them from higher instruction courses limits the scope of these courses' ability to be current and relevant. The pandemic has taken the world to the point where individuals who are not linked to the internet face utter marginalization. With severe social and physical barriers in place, new routines

necessitate internet connectivity for the majority of services. This paper will discuss how university lecturers used digital technologies to teach mathematics throughout the pandemic in three Universities in South Western Uganda.

Materials and methods

Research design

The descriptive survey study design was used to investigate the use of digital platforms by university lecturers in the instruction of mathematics. An online survey through google forms was prepared and used for collecting data. The survey was sent through a website link that could be accessed using a computer or a smartphone. This design was deemed ideal since it allowed data collection from respondents during a lockdown caused by the covid-19 outbreak while observing the standard operating procedures.

Participants in the study

The target population of the study was mathematics lecturers from the selected secondary school teacher training institutions in Western Uganda. The participating teacher training institutions were chosen since they had a significant number of mathematics lecturers and current ICT infrastructure.

Demographic characteristics of participants

Table 1: Distribution of mathematics lecturers by gender and institution

Gender	Number of participants	Percentage (%)
Male	35	78
Female	10	22
Total	45	100
Institution		
National Teachers College Kabale	17	37.8
Kabale University	15	33.3
Mbarara University of Science and Technology (MUST)	13	28.9
Total	45	100

Table 1 shows the demographic characteristics of the participants. There were 35 males representing 78% of the respondents, and only 10 females representing 22% in the group. The low representation of female lectures in this study reflects a larger deficit of females in science and mathematics at all levels, from basic school to university in the context of Uganda.

Instruments

The questionnaire was the only data collection tool employed and it was administered online since it was deemed adequate to avoid researchers' close contact with respondents to strictly comply with the COVID-19 preventive precaution of social distancing. The questionnaire items were developed following the available literature on the utilization of ICT tools and digital platforms in the instruction of mathematics. To ensure the scientific validity of the study, SPSS edition 23 was used to examine the tool for coherence. It provided a detailed analysis on how to enhance each of the items. A reliability Coefficient of 0.786 was produced and deemed adequate (Edwin, 2019).

Data Analysis

Data was analyzed using descriptive statistics such as frequency distributions. This provided a method for analyzing the responses to the survey questions. The Statistical Package for Social Sciences (SPSS) version 23 was used to generate the descriptive statistic.

Ethical considerations

The study's research ethics were upheld at all phases. First and foremost, authorization was requested and granted by Uganda's National Council of Science and Technology. The objective of the study was disclosed to each participating institution's lecturers before the distribution of the survey, and they were free to participate or not. Except for the location where the research was done, no name of the institution or name of a participant has been disclosed in this paper.

Results

The findings show how mathematics lecturers in teacher training institutions used digital platforms for teaching mathematics in the period of the COVID-19 outbreak.

Table 2: Lecturers' most used ICT tools

Application	Every time	Often	Sometimes	Rarely	Never
Computer/Laptop	20 (44.4%)	7 (15.6%)	7 (15.6%)	11 (24.4%)	0
Projector	7 (15.6%)	11(24.4%)	11(24.4%)	16 (35.6%)	0
Presentation Software	7 (15.6%)	0	7 (15.6%)	11(24.4%)	20 (44.4%)
Graphical Solutions	0	7 (15.6%)	14 (31.1%)	7 (15.6%)	17 (37.8%)
Word Package	19 (42.2%)	7 (15.6%)	10 (22.2%)	0	9 (20%)

SPSS	0	7 (15.6%)	14 (31.1%)	18 (40%)	6 (13.3%)
Smart phone	40 (88.9%)	0	0	3 (6.7%)	2 (4.4%)

The use of various types of ICT applications in the mathematics classroom by lecturers should be consistent with the objectives they set for their classroom. Lecturers were asked when they last used ICT applications in teaching and learning mathematics at the university level before and after the Covid-19 disease breakout. Table 2 shows that 44.4% of the respondents regularly utilized computers. It also shows that 15.6% of respondents utilize a projector and presentation software regularly. The results indicate that smartphones are used by 88.9% of the lecturers because they are easier to access and use. Lecturers were found to be familiar with Microsoft Word products, with 42.2% saying that they use it regularly to generate slides for teaching. There were no lecturers identified who did not use any kind of software in their classroom.

Online applications used in mathematics instruction

Digital environments are linked to the use of online programs and the internet in the mathematics classroom. The emphasis here was on the use of common digital apps that lecturers reported utilizing in instruction, as well as the sharing of learning materials and online assignments within the context of a digital mathematics classroom.

Table 3: Digital apps commonly used in the digital classroom

Application	Always	Sometimes	Never
Google meet	6 (13.3%)	23 (51.1%)	16 (35.6)
Microsoft teams	7 (15.6%)	34 (75.6%)	4 (8.9%)
Moodle	8 (17.8%)	23 (51.1%)	14 (31.1%)
E-mail	4 (8.9%)	30 (66.7%)	11(24.4%)
Zoom	11(24.4%)	16 (35.6%)	18 (40%)
WhatsApp	12 (26.7%)	33 (73.3%)	0

Table 3 shows that the majority (26.7%) of participants had excellent experiences with WhatsApp for sharing learning materials and assignments, with 88.9 % from Table2 reporting that it was straightforward, fast, and easy to respond to. This was followed by zoom with a scoring rate of 24.4% usage daily. The majority of the lecturers reported that they are using Google meet, Microsoft teams, Moodle, and e-mail occasionally. Although most lecturers were aware of the existing digital platforms, several were completely uninformed of how to integrate the various applications in mathematics instruction.

Lecturers' challenges in employing digital platforms in mathematics instruction

As a result of the COVID-19 pandemic, many people are working from home all the time, posing challenges in the implementation of their work plans. The respondents noted that using digital platforms for mathematics instruction presented certain challenges. In the context of this paper, challenges refer to the limitations that lecturers find in some aspects of using digital platforms in mathematics instruction.

Table 4: Lecturers' challenges in using ICT tools and digital platforms in mathematics instruction

Challenge	Major	Minor	Not a Challenge
Lack of time in college/University schedule for projects involving ICT	10 (22.2%)	23 (51.1%)	12 (26.7%)
Availability of mathematical soft wares	33 (73.3%)	7 (15.6%)	5 (11.1%)
Lack of ICT professional development trainings	45 (100%)	0	0
Limited access to the internet	6 (13.3%)	22 (48.9%)	17 (37.8%)
Lack of technical support	28 (62.2%)	17 (37.8%)	0
Irregular supply of electricity	7 (15.6%)	2 (4.4%)	36 (80%)
Mathematics lecturers lack pedagogical and content knowledge about ways to integrate ICT in Mathematics lessons.	30 (66.7%)	7 (15.6%)	8 (17.8%)
Inadequate ICT infrastructure for teaching and learning Mathematics	10 (22.2%)	23 (51.1%)	12 (26.7%)
The essential technology is not available to students at home.	39 (86.7%)	4 (8.9%)	2 (4.4%)
Lecturers do not have access to the necessary technology at home	8 (17.8%)	25 (55.6%)	12 (26.7%)

According to table 4, the main problem of lectures in using digital platforms and other ICT tools in mathematics instruction is a lack of ICT professional development training workshops and seminars with a 100% response rate. Other significant limitations identified by lecturers include students' lack of access to necessary technology at home (86.7 %), the availability of mathematical software (73.3 %), a lack of knowledge about how to integrate ICT in Mathematics teaching (66.7 %), and a lack of technical support (62.2 %) in using digital platforms and ICT tools in mathematics instruction in higher education.

Discussion

Teaching from homes presented numerous obstacles, particularly during the COVID-19 lockdown. Frequently, family duties had to be resolved before lecturers could begin their academic tasks. The objective of this research was to examine the utilization of digital platforms and ICT tools lecturers are utilizing in mathematics instruction in public universities in Western Uganda in the COVID-19 era. It also aimed to determine lecturers' challenges to using digital platforms regularly.

Participants generally had pleasant experiences with WhatsApp, Zoom, Moodle, and Microsoft teams, nevertheless, it was clear that they had difficulty with Google meet and E-mail applications. This is evidence that lecturers believe that using digital platforms and ICT tools is valuable and helpful at university-level mathematics instruction, however, the main issue is a lack of training and workshops for lectures to increase their technical capacity on the use of several digital platforms in mathematical instruction. The findings are consistent with those of (Ezumah, 2020) in the literature review who argued that mathematics lecturers' use of digital platforms and related ICT tools for instruction is limited by low levels of ICT skills and continuous professional skills enhancement. Hence, some lecturers of mathematics are resistant to accepting and changing their teaching practices to integrate technology into their courses.

The respondents highlighted that using ICT tools with digital applications was a novel way of learning. For the respondents to properly use these technology channels, this emerging learning approach requires experience, cooperative participation, and training. The finding is consistent with findings of recent studies by Naidoo, (2020) which looked into South African postgraduate mathematics education students' experiences with digital platforms for learning in the era of the COVID-19 pandemic. According to the author, using digital platforms in mathematics instruction can increase the efficacy of the instruction process and students' abilities to comprehend fundamental concepts in mathematics education.

However, using digital platforms to teach mathematics is not without difficulties, as several obstacles may develop. The analysis of the challenges of digital platforms and ICT tools usage shows that lack of ICT professional development training for lecturers was cited by the majority of respondents (100%) as the most significant obstacle. Other major challenges reported were, essential technology is not available to students at home (86.7%), availability of mathematical soft wares (73.3%), mathematics lecturers lack pedagogical and content knowledge about ways to integrate ICT in mathematics instruction (66.7%), and lack of technical assistance (62.2%). The universities administration should explore these important issues.

Limitations of the study

This research adds to our understanding of the use of digital platforms by mathematics lecturers in teacher training institutions in the instruction of mathematics in Uganda in the Era of Covid-19

Pandemic. One of the limitations of this study is that it relied solely on a questionnaire as a research tool. While an explanation for this methodological constraint has been provided, it is sufficient to state that not all of the essential information was acquired, as certain responses required follow-up questions via interviews or other kinds of data collection. The study did not examine the opinions of student teachers, which would have provided insight into how they perceived this novel instructional style.

Conclusion

The participating mathematics lecturers were found to have positive experiences with digital platforms and were eager to incorporate ICT tools into their instruction. It's also vital to recognize the difficulties that the respondents faced. Before connecting with the virtual communities, the respondents mentioned that they required time and space to explore and interact with the virtual mathematics lessons. Before the digital lecture, lecturers should consider giving learners the topic and materials for discussion. This allows learners to initially study the material on their own. Respondents in this study also praised the interactive online discussions, with emphasis on detecting learners' misconceptions of mathematics concepts. Lecturers must be aware of the challenges of using internet technologies in the COVID-19 period. To fix this concern, the lecturer should make sure that learners have access to digital devices as well as data for internet access. Lecturers must ensure that the materials they are using are simple to use, generally accessible, affordable, and data economical. Introductory seminars on the utilization of digital platforms should be provided to students to prepare them to use these channels properly and efficiently.

Recommendation

As we welcome the use of digital platforms in instruction and learning, lecturers should establish data banks and archives to assist mathematics teachers in instruction. Because of the nature of digital platforms, these virtual libraries and online databases could be made publicly available at any time and free of charge, offering an additional level of support to address mathematics teaching and learning difficulties. Because of the study's significance, future comprehensive studies focusing on other teacher learning institutions countrywide and regionally should be done, it might give new insights on the problem. Finally, universities should design ICT policies to assist lecturers and students in using digital platforms for their academic work, especially during this era of the COVID-19 pandemic.

Competing Interest

The authors declare that there is no conflict of interest.

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