The Effectiveness of Virtual Agricultural Sciences Training During Covid-19 Lockdown in Zimbabwe

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Abstract

Agriculture is the main stay of land-locked developing countries like Zimbabwe. Agricultural sciences training at higher learning institutions is pertinent to food security and economies of such nations' long-term viability as they equip industry's stakeholders. The coming of the COVID-19 pandemic disturbed the normal flow of training in higher learning institutions. COVID-19 was easily spread by close contact hence governments had to enact legislation to protect the public by prohibiting congregation. This resulted in virtual learning, a method that is difficult for hands-on training skills, as in the case of agricultural sciences. There is paucity of information with regards to effectiveness and challenges confronting program specific requirements hence the need to assess effectiveness of the virtual classroom on agricultural sciences. Online semi-structured questionnaires delivered via email and WhatsApp platforms for self-administration were used to collect data from the 60 students and an interview for 15 lecturers from Great Zimbabwe University. Thematic analysis and SPSS for association was used for data analysis. The findings indicated that virtual teaching was conducted using Google classroom. A number of challenges, chief among them cost of data bundles, network connectivity and power challenges, were hampering success of virtual platforms. Students were satisfied on theory lectures and not on practical skills training. There was no association ($p>0.05$) between student place of residence and level of satisfaction. Although blended learning is being implemented, there is need to have more

physical interaction so as to instill the practical skills which are critical for the field of agricultural sciences. Also engaging telecoms service providers to allow access of the learning platforms at a subsidized cost.

Introduction

The learning process of millions of youths was adversely affected by the COVID-19 pandemic at a global scale (UNICEF, 2020). Several institutions across the world had to close as a measure to contain the highly infectious COVID-19 disease (Radha, Mahalakshmi, Kumar, & Saravanakumar, 2020). Just like any other sector, the tertiary education institutions have not been an exception (Aday & Aday, 2020; Chandra, 2021). The pandemic came as a shock to the global community with a huge impact on the educational sector of mainly developing countries which rely more on physical classroom. There has been a huge decline of the education system at all levels globally due to COVID-19 lockdowns (Mishra, Gupta, & Shree, 2020). COVID-19 induced lockdowns were instituted globally leaving educational institutions with no option than to embrace online learning (Jena, 2020) which slowly became the new norm. UNICEF (2020) reported that there is urgent need to apply innovative approaches to address education at all levels.

Online learning (virtual classroom) is a teaching and learning environment which is done through the internet (Sufeng & Runjuan, 2013). It can either be synchronous or asynchronous (International Baccalaureate Organization, 2020). In synchronous online learning, students and their lecturer will be learning collaboratively whereas in asynchronous, learning will happen at any time, not necessarily in a group, but with teacher feedback (International Baccalaureate Organization, 2020) as is the case with Google classroom which allows students to ask the lecturer questions regardless of whether he is connected or not. When the lecturer log into Google classroom he can give the response to asked questions. Education is imparted through a plethora of technologies which include video conferencing and worldwide web which rely on computer networks for effective delivery (Dhull & Sakshi, 2017). Virtual classroom is convenient to learners and lecturers due to removal of restrictions in terms of

location, distance and time (Sufeng & Runjuan, 2013). However, poor network connectivity and incompatible devices can negatively affect the smooth flow of the online lectures.

Due to prolonged lockdown period, most educational institutions in Zimbabwe adopted the virtual classroom system. Although the move was in compliance with lockdown measures such as restriction of public gatherings, several challenges were confronted by learners and instructors. The challenges include, poor internet facilities, lack of physical interaction and access to science laboratories. According to UNICEF (2020), only 30.3% of the households in Zimbabwe have access to internet at home which compromises the virtual learning process. Mishra et al., (2020) recommends bridging the gap between the "haves" and "have not" in order to achieve the same outcome when executing online learning. Although Mishra et al., (2020) aver that virtual learning platforms are viable and proved useful to Indian university students, it is critical to assess its viability on agricultural sciences in developing countries like Zimbabwe whose livelihoods are centered much agriculture. Agriculture fits into the grand trinity philosophy by Siyakwazi, (2021) which has the Head, Heart and Hand (3Hs). The interpretation of this is that on the Head we can use our mind to think about what is key to teach; on the Heart it means we have to teach what we would have identified as critical with all our enthusiasm and the Hand mean that we should be hands-on and this is the case with Agriculture. Since online learning is the preferred way during such pandemics as COVID-19, the current research sought to assess the effectiveness of virtual classroom learning on agricultural sciences during COVID-19 lockdown and into the future.

Globally, more than 1.2 billon students have been affected by the COVID-19 induced lockdowns (Chandra, 2021). As a way to by-pass the challenges posed by the pandemic, institutions had to resume learning virtually regardless of programs being offered. There is paucity of information with regards to learning outcomes and challenges confronting program specific requirements hence the need to assess feasibility and effectiveness of the virtual classroom learning on agricultural sciences. Research findings will better inform policy makers on how to structure programmes in the future. Different approaches are suited to different programs thus students in the Mathematics department may not necessarily face the same challenges as those in the Animal Science department. This has caused the researcher to focus on the Agricultural sciences only.

Materials and Methods

Study site

The study was conducted at Great Zimbabwe University, Gary Magadzire School of Agriculture, in Masvingo Province. The School constitutes two departments which are the Department of Soil and Plant Sciences and the Department of Livestock, Wildlife and Fisheries. Soil and Plant Sciences department houses specializations in Crop science and Soil Sciences whereas the Livestock, Wildlife and Fisheries department houses specializations in Animal Sciences, Wildlife and Fisheries. During physical face to face contact, students will do field practicals at the University farm, Desmondale farm, and laboratory practicals were necessary.

Research philosophy

This study was guided by the interpretive research philosophy (Gay, Mills, & Airasian, 2009) which proposes that perceptions are related to interpretations of what the human mind informs us. In interpretive research philosophy, knowledge of the world is based on the understanding which arises from thinking about what happens to us, not just simply from having had particular experiences (McAdams & Cox, 2010; Mozer, 2016). Greater insights were obtained during data collection through instruments (interviews and questionnaires) thereby facilitating the understanding of the phenomenon of virtual classroom from various aspects.

Research design

The researchers employed the mixed methods approach as they intended to collect both qualitative and quantitative data from respondents. According to Frankfort-Nachmias & Nachmias, (2008), a research design is the blue print that enables the investigator to come up with solutions to the problem and guides her humor in the various stages of the research. Thus, a research design is an overall plan of action for obtaining answers to questions being investigated. It deals with at least four challenges, that is, which question to study, which data are relevant, which data to collect and how to analyze the results.

This research adopted the case study approach. Creswell & Creswell, (2018) defines a case study as an exploration of a bounded system through in-depth data collection involving multiple sources of information-rich text.

Target population and sampling procedure

The seventy (70) agriculture students, in their second year of study up to fourth year, and fifteen (15) lecturers in the school of agriculture were the target population in this study. This number of students was large enough for this particular study. A cut off on respondent students was set to level 2 students since these had experienced both face to face learning and the virtual learning system hence assumed to be in a position to purposefully judge the two methods. Systematic random sampling was done to select 85 per cent of the students for questionnaire administration. Purposive sampling was done to select the key informants who were lecturers from the Gary Magadzire School of Agriculture.

Data collection instruments

An online semi-structured questionnaire was delivered to the students via email and WhatsApp platforms for self-administration. This instrument was used because it enabled the researcher to obtain responses concerning perceptions of students on virtual learning in agricultural sciences. The self-administered questionnaire had a likert-type scale to measure effectiveness of virtual learning. The responses ranged from 1 (not satisfied) to 5 (extremely satisfied) measuring effectiveness of virtual learning on: theory content; practical or hands-on skills; interaction among students and their lecturers online.

A semi-structured interview guide was used to collect information from key informants who were lecturers from the Gary Magadzire School of Agriculture. This helped in bringing up an element of comparison and contrasting responses from either side.

Ethical considerations

The four essential parts of consent are disclosure, understanding, capability and voluntariness (Fouka & Marianna, 2011). Informed consent is one of the foundations of research and it means that the participants should understand that they are taking part in research and what the research requires of them. To take care of this, the questionnaire was designed with an introductory paragraph specifying the research objectives. Statement of non-disclosure of participants' details was given. Respondents were given assurance that their responses to the questionnaire used were strictly confidential and were not to be shared with other stakeholders. To ensure anonymity, questionnaires were not to be entered identification particulars of respondents.

Reliability

According to Makewa, Youze, and Fanta, (2014), reliability is an extent to which a questionnaire or other measurement procedure produces the same results on repeated trials. It therefore, represents the consistency of scores over time or across raters. For this study, a pilot survey was conducted with 10 students from another school, school of natural sciences. This was because students in the Gary Magadzire School of Agriculture had similar characteristics with those in the School of Natural Sciences.

Data gathering procedure

The researcher acquired research permit from the GZU registrar's office to conduct research with Gary Magadzire School of Agriculture. The research permit together with the questionnaire were sent to prospective respondents via emails and WhatsApp. After repeated follow-ups, 60 students responded with their filled responses.

Data analysis

Thematic analysis was used to analyze qualitative data obtained. Cross tabulations and chi-square test, in Statistical Package for Social Sciences (SPSS) version 21, was performed to determine independence of variables. The association between student's area of residence and opinion and satisfaction on use of virtual classroom in learning was checked. Key informant interviews substantiated the findings from the self-administered questionnaires.

Results and Discussion

Socio-demographic information of participants

The majority, 80 %, of respondents had a professional qualification, Table 3.1 before enrolling for the programme.

Table 1 Socio-demographic characteristics of respondents on identified variables

Parameter	Categorization	Proportion
Gender	Male	80
	Female	20
Total		100
Age range (years)	21-25	20
	26-30	20
	31-35	40

	36-40	20
Total		100
Place of residence	Urban/Peri-urban	40
	Rural	60
Total		100
Qualification prior to entry into program of study	Advanced level	20
	Diploma	80
Total		100

(n=60)

A higher proportion of males (80 %) were studying towards the agricultural qualification than female students who only constituted 20 % of the respondents. Many prospective students view agriculture as a dirty and manual programme which is best suited to male candidates than females. This view is in line with Enns and Martin, (2015) who posits that lack of female role models, gender stereotyping, and gender bias have been documented in agricultural education research. Also Jayakumar and Surudhi, (2015) asserts that women's participation in higher agricultural studies is significantly lower than that of men. Issues to do with agriculture are central to African economies, therefore, agricultural education should be an integral part of Africa's development strategy.

A wide range of age groups, ranging 20 to 40 years were studying agriculture programmes with the majority in the 31 to 35 years' age group. More agriculture students were coming from rural areas (60 %) with 40 % from urban or peri-urban areas. This background might be informed by the fact that agriculture is a key activity in rural areas and a source of livelihoods therefore young people from rural areas will be well informed about the specialization.

Students' ICT skills

A number of students were able to use various online platforms (Table 2).

Table 2. Statistics for Online platform use (multiple response)

Online platforms	Proportion able to use
Email	100
Skype	60
Google meet	60
Zoom cloud	40
WhatsApp	100
Google classroom	100
TEAMS	20

(n=60)

All students were able to make use of emails, WhatsApp and Google classroom. More than 50 % of the students were in a position to use Skype and Google meet. This gives light to the feasibility of online platforms for academic purposes provided the tools for the job are affordable. There were no significant associations ($p>0.05$) between residence place and use of online platforms, therefore, place of residence does not affect response on satisfaction from online lectures.

ICT gadgets preference and use experience

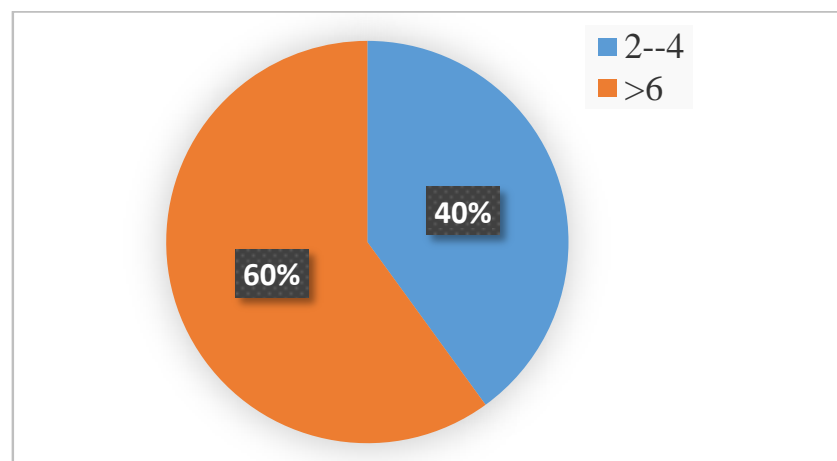The majority of students, 60 %, had more than six (6) years' experience with computers (Figure 1).

Figure 1. Students years of experience using computers (n=60)

All students preferred using their smart phones for virtual learning with only 20 % having indicated using both smart phones and laptops. Mozer, (2016) avers that the major stumbling block regarding the online model of learning is the wider digital divide in technology. Smart phones help to bridge the reported wider digital divide in technology as a result of financial challenges. A higher reliance on smart phones was attributed to the fact that students of the 21st century are well versed with ICT gadgets and since people stay with their phones most of the time, these were easier to use for many students during their virtual studies (International Baccalaureate Organization, 2020). Also because most students rely on mobile network for internet connection. Experience in use of electronical gadgets meant that adoption of virtual learning was expected to be on the high side.

Virtual delivery support

A greater proportion, 60 %, indicated that virtual lectures were effective despite lack of training among the participants. Only 40 % of the students indicated having received training on use of virtual platforms.

All students were for the blended learning approach. Although the contact time allocation between face-to-face and virtual learning varied, the general trend was pointing to more time for the virtual learning. Sufeng and Runjuan, (2013) asserts that too much focus on virtual classroom or internet will cause students to lose their ability to deal with real people in reality. In the same vein, Mozer, (2016) is of the view that blended learning is more effective than either face to face only or online alone. As such, the virtual classroom is regarded as a good complementary of the traditional classroom. In the current study forty percent of the student respondents suggested a 60:40 contact time for online versus face-to-face contact. Lesser ratios which came out were 80:20; 50:50; 70:30, for online as to face-to-face delivery, with each ratio being opted for by 20 % of the respondents. The suggestions from students were in line with what some staff members highlighted. One of the staff members pointed out that:

Virtual teaching has changed the way we deliver to our students. It enables me to reach out to my students more efficiently and effectively through chat groups, video meetings, and also document sharing, especially during this pandemic. My students also find it easier to communicate on WhatsApp. I will stick to WhatsApp and Google classroom even after the

pandemic because it enables me to quickly reach out to all students whilst I will be doing other things rather than being in a classroom physically all the time. Face-to-face learning and virtual learning can go hand by hand.

Share of virtual platforms used

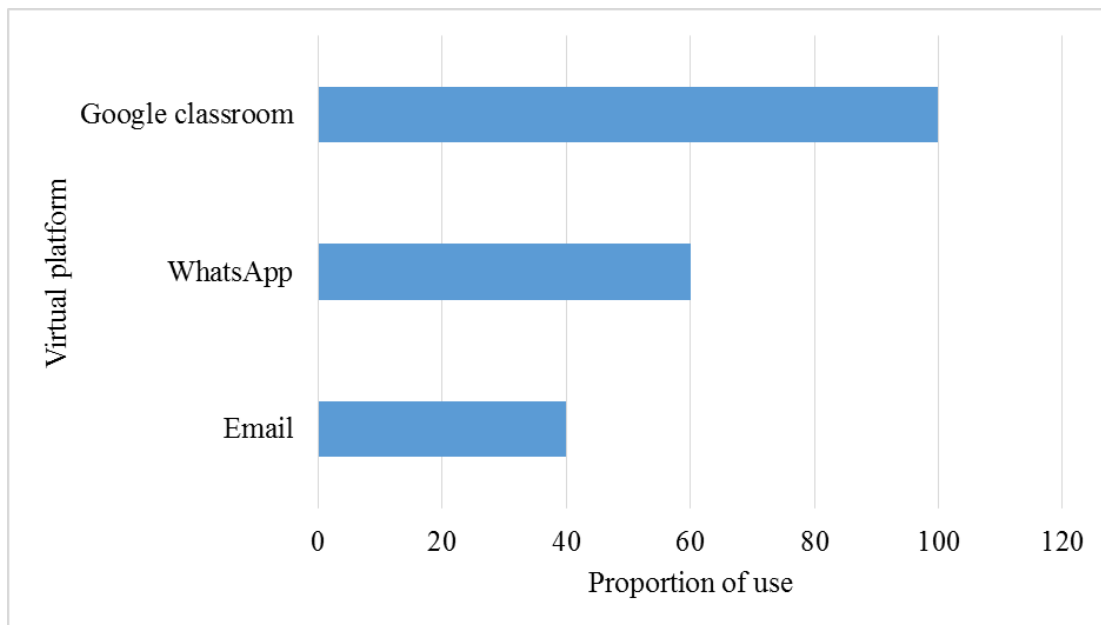Google classroom was the major virtual learning platform used (Figure 2).

Figure 2. Share of virtual platforms that were used

Despite students being able to use a number of online platforms, Google classroom was the main source of communication between lecturers and students. This is because the university authorities had made use of Google classroom mandatory and the only official acceptable communication for use during the lockdown period for university business between students and lecturers. A reasonable proportion, 60 %, reported sharing information on WhatsApp, a social media platform, for communication with lecturers. Although WhatsApp need internet connection and internet data to connect, the WhatsApp platform suited all students as it is cheap to access the interface compared to other online platforms such as Google classroom.

Evaluation of virtual learning

All respondents agreed that virtual learning took place using one of the platforms they were aware of. However, there was variability in terms of satisfaction from the virtual delivery done (Figure 3).
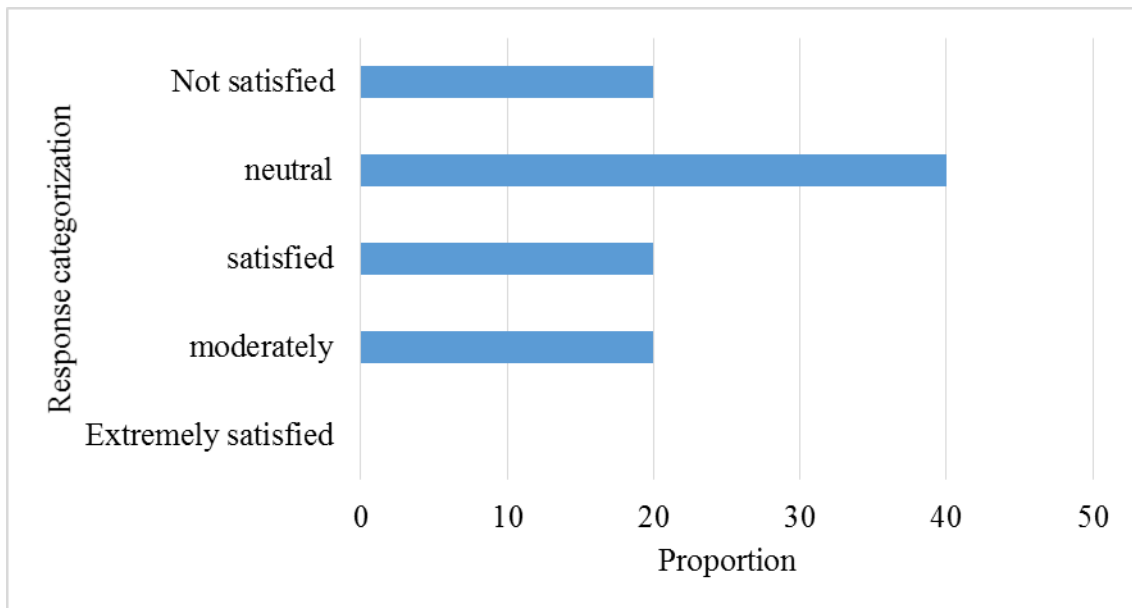
Figure 3. Satisfaction from virtual delivery

The majority, 40 %, of respondents were neutral in terms of satisfaction from the online lecture deliveries. This might mean that students were in-between, neither satisfied nor disappointed. Only 20 % of the respondents were clearly unsatisfied from the online deliveries. There were no associations between residence place and satisfaction from virtual delivery (p>0.05). On the other hand, low satisfaction of students might be to do with the lecturing approach which was used before the online platforms adoption. Students might have been used to lecturer-centered learning approach and now they were shifted to student-centered approaches where they had to lead the direction of learning. In lecturer-student centered approach teaching is primarily a means of transmitting knowledge to students, therefore, emphasis is put on structuring, organizing, and delivery of the course content to make it easier for students to comprehend.

Table 3 shows the general evaluation of online learning platform on a number of measurable parameters from respondents.

Table 3. Virtual learning rating on various parameters

Measuring parameter	Proportion for each category				
Virtual learning rating on:	Extremely satisfied	Moderately satisfied	Satisfied	Neutral	Not satisfied
Theory		40	20	20	20
Hands-on work			20	20	60
Interaction with colleagues	20		40	40	
Lecturer-student interaction	20		60	20	
Gesture use		20		40	40

Satisfaction levels were generally on the low side. A number of students, 40 %, were not satisfied at all on use of gestures on virtual platforms. This finding is in line with Butnaru et al., (2021) who also documented a lack in interactivity when compared with classroom learning. Sufeng and Runjuan, (2013), points out that in the traditional classroom, lecturers interact with students and make demonstrations hence students can learn a lot from the gestures. The lecturers can also alter their strategies according to the reaction of the students. In the current study, this seemed almost impossible for the virtual learning platforms.

As this virtual delivery was happening for the first time at Great Zimbabwe University, it was a success since students managed to have module material from their lecturers online. However, going forward there is need to improve on delivery so that the majority of the students will be satisfied with the virtual platforms. There is also need to train students so that they improve on their skills to use online learning platforms. Overall, students' expectations were met though there is room to improve. Some of the students' responses captured were:

The virtual learning was a success since we managed to get handouts, assignments and feedback on work we had been tasked to do. This is the same with the face-to-face lecture delivery, so there were no differences.

However, the fewer numbers who were querying success of the virtual learning had this to say:

Virtual learning was not a success as we continuously experienced poor network connectivity, also practicals which we used to do during face-to-face sessions were not given justice.

Agriculture is a practical subject, which should marry theory with the necessary practical skills, hence the principle of the grand trinity (triple H) (Siyakwazi, 2021). As long as the students feel that something is not being covered, their motivation levels remain low. As alluded to by Mozer, (2016), the learning process has two components: internal conditions and external conditions, which promote effective learning. In the current study, motivation as an internal factor and the lecturer's input on practical training as an external factor coupled with interactions with other students, were noted to be affecting effective learning. Therefore, students' views of failure of the virtual learning based on absence of practical training are somehow true. This was cemented by lecturers' views who also pointed out the need to improve on delivery of hands-on skills. This was said to be possible during the limited open window when face-to-face lectures were allowed to polish up on grey areas which would have been covered during the virtual learning. Robust and effective agricultural higher education systems play the vital role of producing the much needed skilled human resource to provide leadership, catalyze and facilitate Africa's development process (Mangheni, Tibatemwa, & Forsythe, 2010) hence the need to give justice to practical skills.

Contrary to Sufeng and Runjuan, (2013) views that with virtual learning there is no limit of time, place, and distance, for developing countries like Zimbabwe, network challenges pulls off this benefit as those from remote areas face connectivity challenges. Virtual learning was not convenient for students in remote areas, especially synchronous learning, due to poor bandwidth as noted by International Baccalaureate Organization, (2020).

Learners become disadvantaged if they are not provided with certain resources for learning independently and online. Due to poor network connectivity, lecturers indicated that they would make use of recordings of their lectures and made available the videos to students so that they listen whenever they had stable network and data bundles. This therefore, means that lecturers were using asynchronous learning approach which happens at any time, not

necessarily with students at the same time, but with instructor feedback. There is need to balance between the synchronous and asynchronous online learning as previously noted by the International Baccalaureate Organization, (2020). Though the asynchronous approach was good to make sure that students received the lectures, students mentioned lack of contact as a challenge as there was no direct contact to facilitate real time question and answer sessions. Ironically, students reaffirmed Plato's criticism of writing over face-to-face discussion (Li & Lalan, 2020). If you ask an inanimate object, in this case a piece of writing, a question, Socrates says, you don't get an answer. Instead, it goes on "telling you just the same thing forever." Ask a video a question, or a podcast, and you will not get a response. You can't engage it in dialogue, and as Socrates says, it's in dialogue - teasing out of ideas, challenging them, argument and counterargument - that genuine education happens (Li & Lalan, 2020).

Challenges faced by students during virtual learning

Students indicated a number of challenges hindering smooth learning during their virtual learning sessions, with mobile network and power challenges topping the list, Figure 3.4.
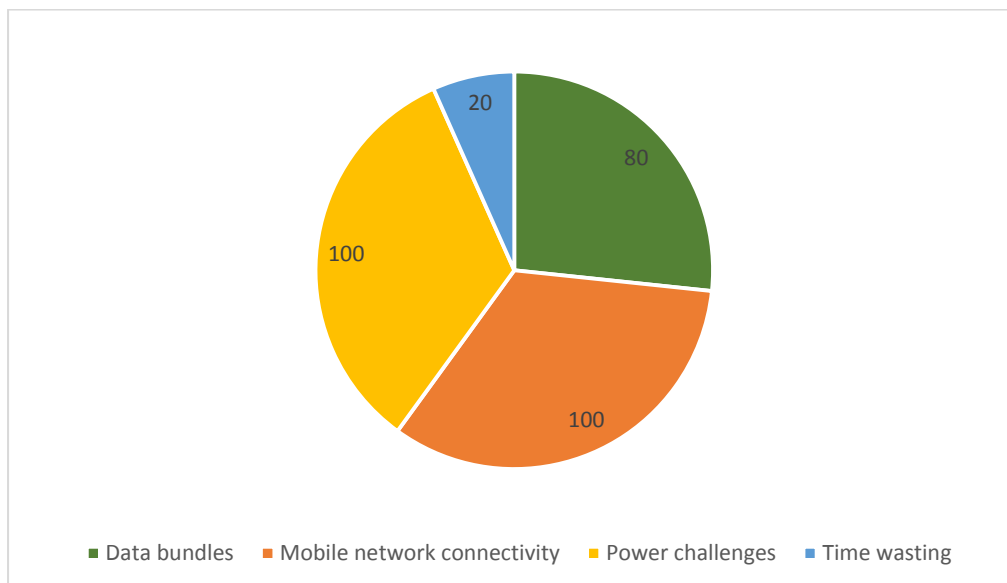

Figure 4 Stake of challenges faced by students during virtual learning (multiple response)

Mobile phones use more power when connected on internet and most of the students indicated residing in rural areas. In rural areas power to charge phones is a challenge and also network coverage is poor in some remote parts of Zimbabwe. Mobile network challenges were one of the major challenges confronted cementing UNICEF (2020) findings that only 30.3% of the households in Zimbabwe have access to internet at home. This compromises the

learning process and further extend the background difference divide among the resource endowed and low resourced students hence a feeling of exclusion reported by Butnaru, Niță, Anichiti, and Brînză, (2021).

Data bundles were also noted as a challenge in virtual learning delivery. Despite the efforts by the Ministry responsible for Higher and Tertiary Education to engage network service providers to have special affordable e-learning data bundles, the cost of the data bundles versus the amount used up in these virtual learning platforms was beyond the reach of many students. This is in support with Cheshmehzangi, (2021), who asserts that much impacts will be felt by countries with struggling economies as the majority will be earning below poverty datum line. No students indicated their mobile phones not user friendly, therefore, use of gadgets was not a challenge.

A lesser proportion of respondents indicated wastage of time as one tries to connect to the virtual platforms. This is in line with what some lecturers indicated saying the online platforms, like Google classroom, require data for one to be able to access it. Also the platforms require a stable and strong network connectivity to avoid disruptions during the lectures. Now that virtual classrooms are becoming the norm, this calls for government to speed up their long term plans to cover all the corners of the country with network.

Other challenges mentioned include lack of physical contact between the lecturer and the students. Some students stated that,

In a face-to-face lecture, a key point gets reiterated in every response given during the course of discussion. Now that we are conducting lectures virtually and sometimes we just follow posted audios or videos, there is no longer that emphasis on key points.

The statements showed that students missed the interaction they used to have when conducting lectures face-to-face in traditional teaching. The central difference noted was that during a regular semester, the lectures are conducted in person, and not on a screen. Before the onset of Covid-19, depending on discipline and area of study, participatory methodologies like experimentation, field trips and supervised practice (Mupfumira & Nyaruwata, 2020) were the norm in disciplines like agricultural sciences. This meant that students were moving in groups of various sizes depending on size of their class and nature of the task at hand. This approach helps students to pay attention when the lecturer is in the same environment as

students. Students get more out of what lecturers will be saying when they can see their body language, and it's more of a personal experience.

Virtual learning takes away a lot from student experience. One student wrote that:
The virtual learning removed the chance to learn from other students' experienced during discussions in classroom and breaking into smaller groups hearing other groups heckling sounds or commenting on each other's test pass mark.

In a traditional classroom, there is this level of intimacy that cannot be equated to virtual setting (Li & Lalan, 2020). The college experience is truly about making human connections. Universities are like small towns with people of different backgrounds but are there to achieve the same goal. Thus there is so much more than just classrooms at a university.
Some students indicated limited time to allow them to re-write assignments which they will not have done well. This calls for lecturers to quickly check written work and return comments in time to allow retakes if need be.

Suggestions to improve conduct of online training
University should continue to offer training to students on how to use online platforms. Students need mentorship so as to stream line their study habits and computer skills for them to gain much from online learning as alluded to by Mozer, (2016).
Lecturers need to keep on improving on their delivery skills to keep students engaged during their online sessions, otherwise they will end up distracted with other social pages and loose track. Herman, (2020), reported that some students indicated that it was easy to let classes slide and not take them as seriously as they would do in face-to-face lectures before COVID-19 outbreak. This lack of seriousness can be a result of some distractions which the online system is associated with. Some students, in a survey by Herman, (2020), reported that they had the biggest source of gaming, shopping and socializing right in their face when they are supposed to be concentrating in an online lecture going on. This calls for lecturers to be innovative enough to avoid their online sessions being boring and encouraging students to engage in other activities.

There is need to have an online timetable for modules being taken so that learning becomes normalized as in the traditional set-ups. Without a timetable, students can lose track of once in a while lecture being conducted by some of the staff members.

Government to improve support on infrastructure so that network covers the whole country especially remote areas where a good number of students come from and will be operating from during lockdowns. There is also need to have online platforms which can be accessed without data charges. This will help to easy on costs of conducting virtual learning.

Use of recorded videos or animated videos to demonstrate practical skills can help students in practical training. Videos may also be used to better describe some complex processes.

In conclusion, virtual learning is feasible and a potential paradigm shift into the future as it enables students to continue with their studies without risking contracting the pandemic. Virtual learning can be conducted using available online platforms depending on preference. Major challenges were related to cost of data bundles, network connectivity and power to charge phones. Generally, students were satisfied on the theory part whereas the imparting of practical skills was not satisfied. Overall, students were just satisfied on use of virtual platforms.

The researchers recommend a blended learning approach, with 60 % virtual learning and 40 % face-to-face, to improve hands-on skills among graduates. Scheduling all virtual learning is necessary so as to normalize lecture time and make use of registers to encourage students to always attend the lectures. There is need to encourage more female candidates to engage in agricultural sciences, research, innovations and technological development which would lead to increased numbers of female agricultural professionals.

Disclosure statement

The author(s) did not report any conflict of interest

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