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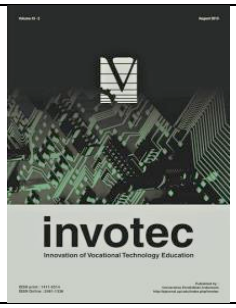

Integrating educational technology in the delivery of design-based courses at a technical teachers' college in Zimbabwe

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ABSTRACT

Educational Technology became vital in the teaching and learning process, particularly during the Covid-19 era. However, a host of challenges associated with the integration of ET in the teaching and learning process were unearthed. This study sought to establish the extent to which Educational Technology was integrated into the teaching and learning of Design-based subjects at the diploma level during the COVID-19 pandemic and to explore strategies that can be adopted to improve the quality of teaching and learning in teacher education in times of crises. The study employed a qualitative approach methodology utilising a case study research design. A sample of five lecturers and twenty students was purposively selected. Data were analysed thematically. Results revealed that lecturers have adequate content knowledge about the design-based subjects which they teach but do not have sufficient technological and pedagogical knowledge. The study recommends in-service training of lecturers to effectively use educational technology in teaching processes.

1. Introduction

The importance of Educational Technology (ET) became more pronounced during the COVID-19 pandemic. Teaching and learning had to continue amid lockdowns that were imposed by governments inhibiting students from attending face-to-face training and education. Distance learning through online platforms like Google meet, zoom application, Google class and eLearning were endorsed for the continuity of education in institutions of learning (Addamando 2021). The curriculum at Dzidzo Technical Teachers' Çollege includes Arts, Commercials, Sciences and Design-based subjects. Design-based subjects include Art Design and Technology, Building Technology and Design, Agriculture, Textile Technology and Design and Food Science Technology. These comprise theory and a practical component which had to be delivered even during the pandemic. ET had to be integrated into both practical and theory lectures for the continuity of teaching and learning during the COVID-19 pandemic to produce adequately trained graduates (Razak and Alakrash 2022). COVID-19 highlighted the problem of the digital divide in education and the lack of digital infrastructure and access in many societies especially those where internet penetration is low (Azlan, Hamzah, Sern, Ayub and Mohamad 2020).

Integration of ET into the curriculum at the tertiary level was imperative across the globe as a teaching and learning strategy for the continuity of education during the COVID-19 era. ET such as

online or virtual learning platforms has been used to impart knowledge and skills through smartphones, computers and tablets. The software packages for ET such as PowerPoint presentations, video clips, internet homework and notes on documents can be sent to students through an online learning platform so that they grasp concepts and skills. ET proved to be vital since it provides instant information from the lecturer to the students and vice versa notwithstanding the distance.

Researchers in different parts of the world investigated the teaching and learning process during the COVID-19 pandemic with very little on Design-based subjects. The study done in Belgium revealed that there is limited integration of ET due to the inability of the teacher education programmes to build technical knowledge and skills to deliver; lack of funding for resources and absence of direction related to e-learning design and delivery (Christopoulus and Sprangers 2021). Teachers in Belgium are reported to be using ET tools to give simple tasks to students and this has been attributed to the limited digital competencies of teachers to give complex tasks (Ibid). This implies that although the integration of ET has been done, barriers such as digital incompetence by lecturers hindered the full implementation of ET thus, theory and practical skills of Design-based subjects could not be imparted to satisfaction (Bukola 2022; Kisirkoi and Kamanga 2022; Johnson, Jacovina, Russell and Soto 2016). In Pakistan, resistance to the use of ET was the major barrier hence an interesting push was done by the government which forced foreign nationals mainly teachers and lecturers who were resisting implementation to resign and return to their home countries (Muhammad, Muhammad and Ather 2022). Foreign educationists were claiming it was impossible to teach practical demonstrations through online education means. This means educationists faced problems in imparting skills through online platforms.

Research conducted on Africa as a whole indicates that the integration of ET in the delivery of Design-based subjects is partially done due to a wide range of challenges. These include limited electricity infrastructure and technology connectivity; a non-conducive learning environment and limited professional development and training of teachers (eLearning and EdTech 2020). If such challenges were all addressed then ET integration would be a success during the COVID-19 pandemic era. Findings from a study in Rwanda indicated that online learning developed skills in the use of technology, and enabled solving related technical challenges of critical thinking and research skills but leaving out hands-on skills (Nsengimana, Bazimazik, Nyirahabimana, Mushimiyimana, Mutarutinya, Mugabo and Nsengimana 2021). This study shows that the challenges were found mainly in the teaching strategies for hands-on skills using ET. Educational instructors seem not to be familiar with methods to use when teaching the practical component of Design-based subjects using ET such that students acquire the necessary skills.

In Kenya, both lecturers and learners did not have the knowledge and skills to use online platforms for learning (Kisirkoi and Kamanga 2022). This means that even if teachers were experts in their subject areas, they lacked the methodological expertise to deliver using ET. On the other hand, students, who look up to their lecturers for guidance were in a dilemma as they could not get the necessary skills and competencies as stipulated in their course outlines. As such, both lecturers and learners needed to be prepared on how to use an online platform in the teaching and learning of both theory and practical components of their subjects.

Learners from a poor background in South Africa, for example, from townships could not access ET (Mkhlze and Mogamat 2021). This implies that less privileged learners could not have adequate resources like online gadgets and even data to access the internet hence they could not access online learning material. Even if the lecturer has integrated ET and posted learning material on the online platform and if learners fail to access the material then one can safely say teaching and learning have not taken place. In this case, the teaching and learning process can be a success if the government avails resources to both lecturers and students so that live online lectures are done, learning materials are posted on an e-learning platform and the students access the lectures and educational materials.

Zimbabwe like other developing countries embraced the use of ET for the continuity of the education system during the COVID-19 era. However, some of the barriers identified in technology-based teaching include lack of infrastructure, learners' access to the internet and computing devices, and lecturers' skills in teaching Design-based subjects (Maphosa 2021). This means that lecturers

face challenges in imparting knowledge and skills in Design-based subjects since the practical component requires hands-on skills which may be difficult to deliver through online technologies. Christopoulus and Sprangers (2021) assert that Design-based subjects have been considered to have been challenging lecturers on how to teach practical subjects through an online platform so that students acquire skills.

The research gaps exist in understanding effective teaching methods for practical skills in Design-based subjects using ET. Lecturers struggle to develop online teaching strategies, and learners face difficulties accessing online materials due to resource constraints. The Zimbabwean context presents unique challenges, including limited infrastructure and the digital divide. This study sought to address these gaps by investigating ET integration, effective teaching methods, and strategies for continued professional development during the COVID-19 period. The research explored these areas, in order to contribute to the development of effective ET integration strategies, and enhancing teaching and learning outcomes in Design-based subjects in Technical Teachers' Colleges in Zimbabwe.

2. Statement of the Problem

Integration of ET in the teaching and learning process proved to be critical in promoting continuity of learning during the COVID-19 pandemic where face-to-face lectures were limited. Online teaching methodologies were predominant. Students doing Design-based subjects also had to continue learning during the same period. These subjects require workshops/laboratories, specialised equipment and machinery, demonstrations, hands-on practice and the production of real products through various processes. As such this study intends to establish the extent of integration of ET in the teaching and learning of Design-based subjects at Dzidzo Technical Teachers' College in Harare for improved content, pedagogical and technological knowledge delivery.

3. Research Objective

The study aimed to:

1. Evaluate the extent of integrating Educational Technology in the delivery of design-based subjects at the diploma level during the COVID-19 pandemic.
2. Explore strategies that can be adopted to improve the integration of Educational Technology in the teaching and learning of Design-based subjects during the COVID-19 pandemic.

4. Theoretichal Framework

The study was guided by the TPACK model proposed by Mishra and Koehler (2006). The model provides a useful framework for understanding technology's function in the educational process. TPACK holds that educators deal with three types of core knowledge which are technological knowledge, pedagogical knowledge and content knowledge as shown in Figure 1.

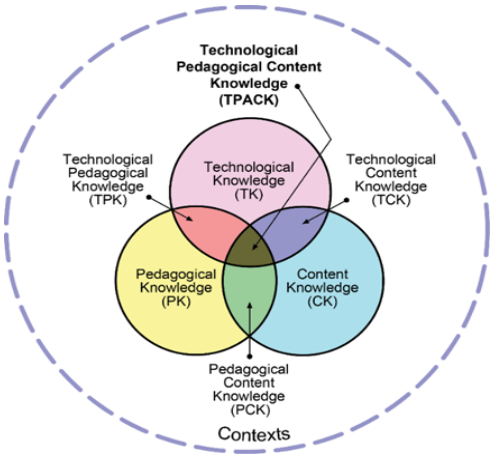

Figure 1: TPACK Model adopted from Mishra and Koehler (2006)

Content knowledge refers to knowledge of the subject matter. With regards to this study, one has to have technical knowledge and skills to impart the best for the specified Design-based (technical) subject. *Pedagogical knowledge* is knowledge of how to teach the subject. A lecturer should know the strategies to use when teaching a specific topic or a specified practical skill such that students grasp concepts and skills wholly. *Technological knowledge* is the knowledge of how to use technological or digital tools for content delivery. Key to this model is the integration of technology knowledge, pedagogical knowledge and content knowledge to produce something new thereby creating meaningful learning experiences in specific learning situations. In this case, a lecturer has to know the content and appropriate teaching methods for a specific skill to be imparted to students and then merge these with technological knowledge for meaningful learning to take place.

5. Literature Review

5.1 Integration of Educational technology in the delivery of Design-based subjects

According to Kimmons (2018), ET integration refers to the meaningful use of technology to achieve educational goals. This implies that the integration of ET promoted the continuity of teaching and learning during the COVID-19 pandemic. Pozo, Echeverria, Cabellos and Sanchez (2021) revealed that ET contributes to 21st-century competencies such as autonomy, collaboration, critical thinking, innovation and problem-solving. These competencies are required by Design-based students since they learn and apply them in their day-to-day living even in this COVID-19 era.

ET keeps students engaged, whether students are working independently or as a team; technology engages students because it is interactive (Patel 2021). Patel (2021) agrees that technology encourages teamwork and collaboration as students share notes and information on e-learning platforms. This means students may learn together and solve problems through sharing ideas among themselves using ET. In addition, ET integration in teaching and learning prepares students with life skills which they can use beyond the classroom after graduation because careers use at least one aspect of Microsoft Office or Google Drive on a daily basis or attach documents to emails (Patel 2021). As students learn to use ET they become used to features in Microsoft Office in such a way that after graduation they can continue using it without any challenges which becomes an added advantage for progress in their careers.

However, in as much as it can be rewarding to integrate technology into teaching and learning, practical skills cannot be fully imparted (Christopoulus and Sprangers 2021) as compared to the theory aspect. Sangheon, Jaime, Michal and Borhene (2021) added that practical training is not easily deliverable through remote modalities. Grasping skills and competencies in practical areas seems to be a challenge since skills are difficult to develop through virtual learning. For example, in Building Technology and Design one cannot construct a building before acquiring setting out skills which are difficult to do virtually because the presence of the real ground on which setting out and building construction is going to take place is very important. This means that it is very difficult to impart hands-on practical skills using ET.

Christopoulos and Sprangers (2021) identified the role of lecturers and educational context (technical aspect) as the most influential factors governing the integration of technology in tertiary education. This implies that lecturers play a significant role in content preparation, teaching strategies and content delivery. However various challenges have emerged as a result of integrating ET into the teaching and learning of Design-based subjects. Akram (2021) asserts that the COVID-19 pandemic led to a shift from traditional methods to online strategies of teaching and learning by integrating ET even though lecturers were not prepared as to how they would impart knowledge and skills to students while they were far from the learning institution. Lecturer incompetence seems to have contributed to their negative attitude and resistance (Muhammad et al. 2022) to ET integration in the teaching and learning of Design-based subjects. Johnson et al. (2016) concur and add that internal barriers to the integration of ET include lecturers' attitudes, resistance towards technology in class and lack of knowledge and skills to integrate technology. This is a big challenge as lecturers

were not conversant with the implementation strategies in the use of ET resulting in ripple effects in the teaching and learning process during the COVID-19 pandemic.

In the same vein, Patel (2021) postulates that teachers lack knowledge and understanding of how to use technology and therefore demonstrate resistance to change and unwillingness to adopt education technology. Akram (2021) adds that without adequate competencies it becomes difficult for lecturers to organize instructional programs efficiently which involves planning, teaching methods and content technology integration. This implies that lecturers end up using inappropriate teaching methodologies due to technological incompetence. Additionally, inadequate training (Pozo 2021) of teachers in ET contributes to their inability. If lecturers are not provided with effective professional development programmes on new technologies, they cannot use them effectively (Johnson et al., 2016). In a research conducted by Tayyaba, Gulnaz, Naseem and Maham (2021) and Coman, Tiru, Mesesan-Schmitz, Stanciu and Bularca (2020) students reported difficulties in online learning. This could have been caused by inadequate training by incompetent lecturers. This implies that graduates produced by incompetent lecturers may not apply such technology in their life beyond graduation.

Patel (2021) postulates that the cost of new technology, laptops, desktops, tablets and smartphones is very high. Acquiring funds to implement and sustain technology is a major barrier to its adoption. Lecturers may get the gadgets but students from poor backgrounds may not afford them. According to a survey of 52 African countries by Damani (2021), more than three-quarters of education and technology professionals think that the move to online learning increases inequality and disadvantages poorer and more marginalised students. If students do not have relevant technological devices, it becomes difficult for them to access lectures virtually. Johnson et al. (2016) added that the lack of strong infrastructure can also be compounded by a lack of reliable devices and software for the adoption of ET. Connectivity termed access constraint (Johnson et al. 2016) is another challenge. If the college does not have strong internet connectivity, the integration of technology, especially online learning is negatively impacted. Lecturers may then be forced to use their resources to purchase data bundles which then become a hindrance to technological integration when they fail to purchase and deliver the lessons. Students in remote areas where connectivity is usually a problem may fail to receive learning material from the lecturers which becomes a barrier to the teaching and learning process.

5.2 Strategies to be adopted to improve Educational Technology integration

Staff development of lecturers in the integration of ET is vital since it boosts their confidence during teaching and learning (Johnson et al. 2016). In line with this, lecturers should be trained to use several software and be allowed to choose educational technology they feel comfortable with. Choosing their software, and internet tools boost lecturers' confidence in integrating technology during teaching and learning.

Lecturers should embrace a student-centred learning approach (Johnson et al. 2016). This implies that a lecturer should serve as a facilitator who guides learners as they interact with technology to acquire knowledge and skills. Learners

should be given practical problem-solving assignments through ET which require critical thinking and research to find solutions, by so doing students grasp concepts and acquire skills in a better way than through traditional methods of learning. Infrastructure such as reliable devices, software and connectivity should be availed so that ET can be integrated fully during the teaching and learning of Design-based subjects (Johnson et al. 2016). In this case, infrastructure should be made available for both students and lecturers for the integration of ET to be a success.

6. Methodology

This section outlines the research design and methods used to investigate the integration of Educational Technology (ET) in Design-based subjects at Dzidzo Technical Teachers' College. Figure 2 shows the flowchart on the research method to make the methodology clearer.

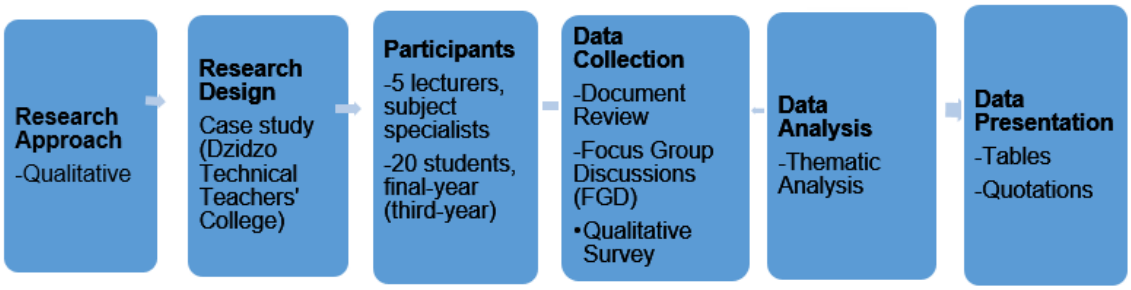

Figure 2: Flowchart on methodology

This study utilised a qualitative research approach. A case study of one Technical Teachers' College situated in Harare, the capital city of Zimbabwe was purposively sampled. The case study design was used in this study since it requires a small number of participants which makes it easier for the intense (Suchita et al., 2023) descriptions and understanding of the participants (Struwing & Stead 2004). The pseudonym Dzidzo Technical Teachers' College was used for ethical reasons. A sample of five lecturers and twenty students was purposively selected. Participation in this study was voluntary, and a privacy policy was adhered to in line with ethical protocols. There were no incentives for participation. Lecturers involved in this study were the respective subject specialists while students were the final, third-year students who had enrolled in January 2020 just before the first COVID-19 lockdown in March 2020. To establish the extent of integration of the ET, document reviews were conducted where teaching programmes for the five Design-based subjects were analysed. This was substantiated by data from a Focus Group Discussion (FGD) with lecturers and qualitative survey data from students. Achievements and challenges encountered during the integration of ET in these Design-based subjects since the inception of COVID-19 were unearthed through FGDs with lecturers and open-ended survey questions with students. These were also reflected in the comments written by lecturers in their evaluated teaching programmes. Both lecturers and students proposed some insights into the identified challenges through FGDs and responses to the survey. Some suggestions were also echoed through evaluations in the teaching programs of various Design-based modules. The thematic data analysis procedure was employed. The data is presented in the form of tables and quotations from participants. Paton (2002) concurs that descriptions and direct quotations provide the basis for qualitative reporting and allow the reader to enter into the situation presented. However, the quotations were applied in a way that maintained the participants' confidentiality (Polit & Beck 2016).

7. Results and Discussion of Findings

Findings were based on the data gathered from document reviews of Design-based teaching programs; a Focus Group Discussion (FGD) with lecturers and questionnaire data from students. For ethical reasons teaching programs and participants were coded according to their different subjects as follows:

Documents- ATD, BT, AGR, TTD and FS

Lecturers for Design-based subjects-L1, L2, L3, L4, L5

Final year students doing Design-based subjects- S1, S2, S3, S4 to S20.

7.1 The extent of integrating Educational Technology in the delivery of Design-based subjects at the Diploma level

Table 1 presents data from teaching programmes used by lecturers in various Design-based subjects as extracted from document reviews. Data obtained was for terms 1 and 2 of the student's third and final year of training. The methodologies used were either Educational Technology (ET) or traditional methods (TM).

Table 1: Frequency of the use of Educational Technologies against traditional methods

Skill	Teaching Programme	Possible	Actual									
			ATD		**BT**		**AGR**		**TTD**		**FS**	
			ET	TM	ET	TM	ET	TM	ET	TM	ET	TM
Theory	Video tutorials	6	1	-	2	-	6	-	0	-	2	-
	PowerPoint presentations	10	4	6	2	8	3	7	1	9	2	8
	Discussions	14	2	12	3	11	2	12	4	10	1	13
	Pdf downloads	10	2	8	1	9	2	8	3	7	4	6
	Notes on Word documents	12	3	9	4	8	2	10	3	7	3	7
	Tests and exercises	2	0	2	0	2	0	2	1	1	0	2
	Assignments	4	4	0	4	0	4	0	4	0	4	0
Practical	Video tutorials	8	2	-	2	-	2	-	1	-	2	-
	Assignments	4	0	4	0	4	0	4	0	4	1	4
	Projects	2	0	2	1	1	0	2	0	2	0	2

Table 1. shows that there is some integration of ET in the teaching and learning process at Dzidzo Technical Teachers' College. Through FGD, lecturers exhibited their conceptualisation of ET hence their ability to select different methodologies for different activities as shown in Table 1. L1 said:

> *ET is the use of different gadgets like computers, smartphones, e-learning platforms and use of interactive boards in the teaching and learning process.*

Students also expressed their conceptualisation of ET through questionnaires. This enabled them to access uploaded learning material and to participate in different learning activities such as online discussions. S3 and S7 concurred that:

> *ET is the use of Information Communication Technology in teaching and learning with the help of gadgets such as laptops, tablets and smartphones.*

This is in tandem with the definition given by Kimmons (2018) that ET refers to the meaningful use of technology to achieve educational goals. When students were asked about the skills they acquired through educational technology in their subject areas S1, S3, S4 and S10's responded that:

> *Skills acquired through ET include; decorating food, developing new products, designing and drawing using computers, downloading learning materials sent on Modelena, writing online tests and sending assignments through smartphone smartphones, computers or laptops.*

These findings imply that the majority of the students seem to be aware of the skills they obtained through the use of ET. According to Cohen, Soffer and Henderson (2022), students in the countries studied confirmed the use of both official and unofficial digital learning resources

It is evident from Table 1 that ET is predominantly utilized in theoretical components of the curriculum across all Design-based subjects under study. This aligns with Henrie, Halverson and Graham's (2015) observations that digital technology is increasingly used for content delivery, and connectivity. However, Cohen et al.'s (2022) findings also resonate, highlighting challenges in maximizing benefits and understanding perceived usefulness. Notably, both lecturers and students concurred that ET is difficult to apply in practical lessons which require one-on-one interactions. L4 expressed that:

> *I find it very difficult to teach hands-on skills using ET. These require the actual equipment, proper workshops and demonstrations which are not possible through online teaching methodologies.*

All the participants agreed that practical activities and assignments cannot be conducted online. In support of this finding, Christopoulus and Sprangers (2021) reported that practical skills cannot be fully imparted through ET as compared to theory aspects.

Although it is evident through results presented in Table 1 that ET is more inclined toward theory than practical lessons of the Design-based subjects, it has also been clearly shown that the traditional method (face-to-face) is dominating. Amoah's (2024) findings indicated that students still

preferred face-to-face teaching and learning and acknowledged it as the method that enabled them to concentrate and understand the concepts being taught better. According to this study, this has been attributed to a lack of software specific to certain subjects, a lack of electronic gadgets and poor internet connectivity. L1 said:

> *Most students do not have laptops or smartphones to use during the teaching-learning process, those with such gadgets are not compatible with online learning and some cannot accommodate software like auto-CAD which should be used in drawing.*

S12 also said:

> *Purchasing such gadgets is very expensive and students from less privileged backgrounds cannot afford them as a result I am about to complete the course by borrowing or not attending online lectures*.

S2 added that:

> *Data bundles are very expensive such that as students we cannot afford to purchase them hence we fail to access learning materials posted on an e-learning platform as well as upload assignments*.

Mkhlze and Mogamat (2021) concur that learners from a poor background for example, from townships, cannot access ET. Moreover, Afzal, Khan, Daud, Ahmed and Butt (2023) posit that students from low-income households faced lower levels of internet access, indicating a socioeconomic divide in technology access. From these findings and literature, it means students are not fully integrating ET because they cannot afford electronic gadgets which are compatible with online learning and they cannot afford data bundles to access online learning.

Internet connectivity is another challenge that was lamented by the majority of lecturers and students. L2 and S7 said:

> *The network is always slow such that it becomes difficult to have online lectures.*

The majority of students complained about power outages which affect negatively the use of ET. This means when there is no electricity, connectivity can be a challenge.

The majority of lecturers indicated that there is inadequate training to integrate ET into teaching and learning programs. L2's responded that:

> *I do not fully understand ET so it is a challenge for me to impart knowledge and skills through this method*.

L4 shared the same sentiments and added:

> *I can only upload assignments for students to attempt and post notes but downloading and grading students' work is a problem worse still teaching students about using the e-learning platform.*

Bukola (2022) asserts that barriers such as digital incompetence by lecturers hinder the full implementation of ET in the teaching and learning process. It was also revealed by L5 that some lecturers simply do not show interest in trying out new initiatives in their teaching activities as they always want to use their old ways of teaching. Johnson et al (2016) concur that internal barriers to the integration of technology in education include teachers' or lecturers' attitudes and resistance towards technology in class.

Further challenges were revealed by the majority of students who disclosed that they do not have adequate knowledge of using the e-learning (Modelena) platform at Dzidzo Technical Teachers College. S1 said:

> *Training on how to use the e-learning platform was done once in the first year and now I have forgotten how to use it*.

This means training was done only once and was not inadequate to equip students with knowledge and skills on the use of the eLearning Management Systems. S8 added that:

> *I am not knowledgeable about how to use smartphones, laptops and computers for accessing eLearning materials.*

This means students were not adequately trained to use electronic gadgets for learning purposes. Pozo et al. (2021) concur that inadequate training of lecturers and students in ET contributes to their inability to use them in the teaching and learning process.

7.2 Strategies that can be adopted to improve the integration of ET in the teaching and learning of Design-based subjects

Lecturers and students came up with suggestions on how to increase the extent of integration of ET in the delivery of Design-based subjects at Dzidzo Technical Teachers' College. L4 suggested that:

> *Government should provide adequate Information Communication Technology gadgets to both lecturers and students which are compatible with relevant software used in various subject areas so that the integration of ET in teaching and learning becomes a success.*

L3 added that:

The institution should have a fully equipped computer laboratory to be used by students to practice what they use or learn online.

This means there should be an independent, fully equipped computer laboratory only to be used by students for online learning without the interference of non-design-based subjects. Suchita et al. (2023) concur and assert that for effective integration of technology in teaching and learning programs it is crucial to avail adequate infrastructure.

With regards to data bundles and internet connectivity, L1 suggested that:

> *The government should have a policy that network providers should provide cheaper data bundles for students so that they can easily connect for online learning.*

L4 and S6 suggested that:

> *The government should provide free data for lecturers and students for successful teaching and learning through ET*.

S11 also said:

The college should provide us with data bundles. The money can be included as part of tuition fees.

L2 adds that:

> *Internet connectivity should improve, and generators should always be on standby if there are electrical power cuts.*

To improve speed, L5 suggested that the network bandwidth should be increased. Johnson et al. (2016) assert that strong infrastructure such as reliable devices, software and connectivity should be availed so that educational technology can be integrated fully during teaching and learning. From the findings and literature, one can predict the success of ET integration in the teaching and learning process if a strong infrastructure is provided.

Findings revealed that more time may be availed to train lecturers and students so that they acquire relevant skills in using ET. L2 suggested that:

Regular training of lecturers and students should be done so that we get used to using ET in the teaching and learning process.

Long, Tan and Ibrahim (2014) posit that the high competencies of a lecturer lead to student satisfaction and the ability to apply skills acquired when teaching. This means that students would acquire skills if lecturers could impart them.

L3 further suggested that:

> *When training lecturers, emphasis should be given to various teaching strategies, especially on the practical aspect of Design-based subjects.*

To get more acquainted with the use of different electronic gadgets, S16 said:

> *More time should be spent doing online lectures than the traditional face-to-face which are mainly used at the present moment.*

In addition, L5 said:

> *Lecturers and students should shift from traditional teaching and learning to modern methods of using ET.*

Findings revealed that most lecturers are resistant to integrating ET into their teaching activities. This was also evident through the reviewed teaching programs. L2 then suggested that:

> *Every Design-based subject should have a stipulated number of activities that should embrace ET.*

In their evaluations, L1 and L3 commented that:

Most students can at least use some ET for online discussions and assignments. I suggest that these ETs be used in almost every topic provided there are adequate facilities.

Eden et al. (2024) add that ET is made relevant and successful by frequenting the use, varying and improving online teaching and learning strategies. Lecturers and students expressed their willingness to use ET in the Design-based curriculum and this will be made possible with the full support of the college administration and the government.

7.3 Limitations and areas for further research

Although this study brings out insights into the integration of ET in design-based subjects, it was done on a single case study and this limits the generalizability of the results. Further research could be carried out on a larger scale employing both quantitative and qualitative methods to establish how the integration of ET can be utilised in teaching practical tasks. Furthermore, other studies could explore assessment using technology in design-based subjects.

8. Conclusions

The study revealed that in as much as lecturers valued and cited good aspects of the integration of ET in the teaching and learning process during the COVID-19 pandemic, several factors hindered its use and success. The findings revealed that ET is embraced more in theory than practical aspects of Design-based subjects. However, the methodology used in theoretical aspects is skewed towards traditional approaches rather than ET. Challenges faced in the use of educational technology include inadequate electronic devices and gadgets that are not compatible with software; expensive gadgets and unaffordable data bundles to access online learning; poor network connectivity and power outages; inadequate training of lecturers and students and lecturer incompetence and resistance to change. In as much as lecturers have content knowledge, they have inadequate technological knowledge and pedagogical knowledge to deliver practical aspects of Design-based subjects. As such, it is clear that educational technologies are not fully integrated into the teaching and learning process, especially in the practical aspects of all Design-based subjects at Dzidzo Technical Teachers' College.

In consideration of the results obtained, there are implications on the possible ways to improve the integration of ET in the teaching and learning of Design-based subjects. There should be regular in-service training for lecturers as well as students so that they can effectively use ET in teaching and learning processes. Technical Vocational Education and Training institutions should be provided with adequate Information Communication Technology gadgets for both lecturers and students which are compatible with specific software used in various subject areas so that the integration of ET in the teaching and learning of Design-based subjects post-COVID-19 pandemic becomes a success.

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