



# Online Learning and Educational Technology and Skills: Implications for Post-Graduate Certificate (PGCE) students at the University of Eswatini

Peles L. Biswalo  
University of Eswatini  
Email: [pbiswalo07@gmail.com](mailto:pbiswalo07@gmail.com)

**Abstract:** This paper explores the contribution that educational technologies make to facilitate efficient teaching and learning among Post-Graduate Certificate in Education (PGCE) students in the Kingdom of Eswatini. The study addressed two objectives: 1). To identify knowledge levels among PGCE students on the application of educational technology and skills used in teaching and learning and; 2). To establish better ways of delivering the course to prospective teachers in online learning environments. The technology enhanced learning environments (TELEs) frameworks grounds the study. A mixed method approach was used. A questionnaire with both closed and open-ended questions was employed on a conveniently sampled group of (how many) PGCE students. Data analysis employed Google form for quantitative data while qualitative data were thematically analysed. The results of the study revealed mixed responses on the use or application of educational technologies. A total of 68% knew what educational technologies were. Twenty (20%) thought that real materials are not educational technologies while 7% thought models are not educational technologies. To the contrary, two (2%) thought (chart) and 1% (poster) were not instructional technologies. Additionally, 79% disagreed that a whiteboard is the same as an interactive whiteboard while 21% said they were the same. The study therefore recommends thus: a) extensive exposure of prospective teachers to classroom-based instructional/media technologies; b) PGCE curriculum review that includes more practical use of media technology.

**Keywords:** Educational Technology, Instructional Technology, Smart Learning Environments, Constructivist Pedagogy, Technology enhanced learning environments (TELEs).

## How to cite this work (APA):

Biswalo, P. L. (2023). Online learning and educational technology and skills: Implications for Post-Graduate Certificate (PGCE) students at the University of Eswatini. *Journal of Research Innovation and Implications in Education*, 7(4), 653 – 669. <https://doi.org/10.59765/diar572r>.

## 1. Introduction

The rigorous global technological change of the 21<sup>st</sup> century inundates teachers, students and the public at large. Studies have shown that the integration of educational technologies and ICTs in teaching, learning and assessment can lead to enhanced outcomes for both teachers and students (Oikonomou & Patsala, 2021; Mtebe & Raphael, 2017; Sorin & Armenia, 2017; Adesote & Fatoki, 2013; Sánchez, Castro & Alemán, 2011; Ellis, et al., 2008; Shan, 2013). Based on the changing trends in the use of technologies in teaching and learning, and the various modes of learning (e.g., e-learning, online learning, blended learning, mobile

learning, flipped classrooms, etc.) available, the need to explore the educational technology and skills levels of the PGCE students cannot be overemphasised. The objectives of the study were 1). To identify knowledge levels of PGCE students on the application of educational technology and skills used in teaching and learning; 2). To establish better ways of delivering the course to training prospective teachers in online learning environments.

### 1.1 Study Context

The smallest Kingdom of Eswatini with an estimated population of 1.2 million and a per capita (Gross

Domestic Product) GDP of \$3,958 is enclosed within South Africa and Mozambique. The proportion of the population living below the national poverty line fell moderately from 63% in 2010 to 58.9% in 2017, driven by improvements in educational attainment, the coverage of social protection, and labour incomes (World Bank, 2023).

Eswatini Ministry of Education and Training Policy outlines the Information and Communications Technology Policy Goal:

*Teaching and learning content shall be progressively digitised and ICT as a subject area shall be introduced into all schools in Eswatini as qualified teaching personnel and resources become available. ICT will also be used as a tool for teaching and learning of knowledge and skills throughout the education and training sector for blended learning, as well as for management and administration. Safeguards will be introduced to prevent misuse of ICT (MOET, 2018, p26).*

In addition, the MOET policy objectives are:

- To enable teachers to use ICT in teaching and learning of their respective subjects.
- To enable learners to develop knowledge and skills required to use a range of ICT effectively (MOET, p26).

The above policy information clearly shows that Eswatini would like to see ICTs and technologies developed and used in schools to support teaching and learning in schools and other institutions. This implies a need for more teacher training. The study was carried out at the University of Eswatini (UNESWA, in Eswatini (Southern Africa) which offers many programmes, offered through full-time, part-time or distance mode. The current study was carried out to students engaged in the distance mode in the Institute of Distance Education (IDE).

The paper will cover the conceptual framework, literature review, methodology, data analysis and results.

## 1.2 Theoretical framework

The study used technology enhanced learning environments (TELEs) and Technology enhanced learning (TEL) frameworks for discussing the data. TELEs are technology-based learning and instructional systems through which students acquire skills or knowledge, usually with the help of teachers or facilitators, learning support tools, and technological resources (Aleven, et al., 2003; Kim & Hannafin, 2011; Land, 2000; Shapiro & Roskos, 1995). This is based on the constructivist pedagogy, whereby learners explore their own interests and undertake instruction in a flexible manner using different technologies (Al Hamdani,

2014). The evolution of smart learning also brought technology-enhanced learning (TEL) into play. With the development of mobile, connected and personal technologies, mobile learning has become a major TEL paradigm. While TELEs emphasize the learning environment, TEL provides a flexible learning mode. In addition, TEL can be used as a tool for facilitating learners' higher order thinking activities (Lee & Choi, 2017; Tlhoale, Suhre & Hofman, 2016). Technologies as described above can come in the form of media or tools that facilitate flexible access to collaborative knowledge construction and evaluation (Daniel, 2012; Bruce & Levin 1997; Meyer & Latham 2008; Goodman, 2003).

## 2. Literature Review

The literature review section will focus on the following themes, integration of educational technology and ICTs into teaching and learning; Constructivist Pedagogy; Technology Enhanced Learning (TEL); Technology enhanced learning environments (TELEs) and smart learning environments.

### 2.1 Integration of educational technology and ICTs into Teaching and Learning

Information and communications technology or technologies (ICTs) is an umbrella term that includes any communication device or application. As such, ICTs can be simply defined as a broad subject concerned with digital technological tools and resources used to communicate, create, store, manage and process information (Tinio, 2003). These technologies include those that come in the form of technology-enhanced solutions that can be used in the teaching and learning process (Daniela, et al., 2018). They include radio, television, cellular phones, computer and network hardware and software, projectors, satellite systems, and the Internet to mention some. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries (Margaret, 2016).

The use of ICT in education lends itself to student centred learning settings (Noor-Ul-Amin, 2014). Therefore, the quality of technology integration in teacher training courses is essential. Herold (2015) argues on the slow-paced teacher transformation in the adoption of new technologies and approaches to teaching and learning.

Evidence from Tanzania identified extrinsic factors such as lack of computers, poor Internet connectivity, inadequate training and support as well as lack of time as barriers for teachers to integrate educational technologies into the classroom (Lwoga, 2012; Mtebe, Mbwilo, & Kissaka, 2016). Zhao and Bryant (2006) also observed technology integration for teacher education and concluded that the mere use of technology in teacher education is insufficient to make positive changes.

Henceforth, instructional applications should also be taken into account.

Integration of ICT learning enhances the learner's interaction with the facilities (Adesote & Fatoki, 2013; Gu, Zhu, & Guo, 2013). While delivering the class lectures, any innovative teacher needs to use different forms of graphics to explain the critical concepts or even play some video clipping of real time operation. All these multimedia applications can assure learner motivation, interaction and quality delivery of classroom instruction. Additionally, presentation software like PowerPoint can be a good choice for teachers to perform such tasks (Shyamal, 2015). Chukwu, (2011) echoed by Itighise and Wordu, (2018) support the usefulness of ICT and technologies in helping the students in their studies. Equally important is its role in reducing the social disparities between students since they work in teams in order to achieve a given task. Discussion on the application of TELEs in teaching and learning follows.

## **2.2 The application of technology enhanced learning environments (TELEs)**

Digital technology promoted a new vision for teaching and learning across all the education and training. Chatti et al. (2010) summarised the future challenges in education by alluding to learning as fundamentally personal, social, distributed, ubiquitous, flexible, dynamic and complex in nature. The above is possible via technology or commonly referred to as ICTs. In this case, ICT tools support and facilitate learning. Technology, however, is not the focus of the learning process, nor is it all the student needs to learn in such environments.

Technology Enhanced Learning Environments (TELEs) are educational environments where students are actively learning by doing (Al Hamdani, 2014; Lee & Choi, 2017). The emphasis is on learning, and less on the delivery. Based upon constructivist pedagogy TELEs provide learners with opportunities to explore their own interests in a flexible manner (Al Hamdani, 2014). They can use tablets, iPads, PCs, SMART Boards, Laptops, wikis, and online platforms. In this case, students utilize their prior knowledge in synthesizing new information through the support of technology while acquiring new knowledge, skills, and attitudes (Kim & Hannaffin, 2011).

TELEs are a scenario comprising learning objectives, tasks, learning materials, tutors, teachers, other students and technology. In this scenario, learners can play an active role in their own learning process (Kim & Hannaffin, 2011).

TELEs that are designed to support student-centered learning are rooted in five foundations: a) psychological, b) pedagogical, c) technological, d) cultural, and e) pragmatic (Hannafin & Land, 2004). Technology enables learners to adapt, modify, and extend their

learning in dynamic contextualized possibilities. Students have the ability (through new technologies) to experience abstract concepts in applicable and often easily accessible formats. In turn, learners acquire deeper knowledge, skills, and attitudes regarding the topic of discovery.

TELEs lead to an assumption that a students' familiarity with technology can impact on learning success. For example, students familiar with modes of technology (i.e., tablet, PC, laptop, SMART Board) and applications or software (i.e., Zoom, Edu blogs, wiki, Microsoft PowerPoint, Edu creations, etc.) are more likely to succeed (Hannafin and Hannafin, 2010; Smith, Onofre-Martínez, Contrino & Membrillo-Hernández, 2021).

For a successful student-centered, technology-enhanced learning environment, students must be properly supported to learn new tasks or concepts. This support can be provided by teachers, peers, or technology (Daniela, et. al., 2018; Kim and Hannafin, 2011; Shin, Brush & Glazewski, 2017). Scaffolding provides such support and allows students to learn within their zone of proximal development. Witt, Trivedi & Aminalroayae, (2021) report that scaffolding supports student performance in a technology-enhanced flipped instruction classroom. Students that receive scaffolding in a TELE flipped instruction environment perform at a higher rate than those that do not receive scaffolding. Once the student is capable, the external support that scaffolding provides can lessen and instead the student can rely on internal support. Technology Enhanced Learning is our next discussion.

## **2.3 Technology Enhanced Learning (TEL)**

TEL were described in the conceptual framework in the paper. However, TEL is used to describe the application of information and communication technologies to teaching and learning (Kirkwood & Price, 2014). Dissemination of information and materials therefore remains an ongoing issue when it comes to the use of technology. Technology can serve as a supportive educational tool. In addition, it can be used in the form of digital learning materials (Daniela, et. al., 2018). In this regard, teachers need to help each other to discover how best to organise the mix of technologies in support of learning (Beetham & Sharpe 2013, p. 17). The increasing availability and access to new technologies has focussed attention on technology-enhanced learning (**TEL**) and the possibilities now open to educators and offer new avenues to teachers. As noted by Weller (2011), new technologies have the potential to reshape all scholarly areas. The area of teaching holds great opportunities for radical change to emerge in regards to the application of new technologies. With access to online content and new modes of interaction and engagement, traditional forms of teaching are being challenged and new models are emerging such as

MOOCs (massive online open courses) that are generating discussion across the sector.

TEL therefore is a means of supporting new types of learning experiences as well as enhancing existing learning contexts. Moreover, *'interactive and cooperative digital media have an inherent educational value as a new means of intellectual expression and creativity'* (Laurillard, Balacheff, Ludvigsen et. al. 2009, p. 289). Wang (2008) suggests a model of ICT integration that includes pedagogy, social interaction and technology focusing on the pedagogical affordances, social affordances and technological affordances when designing TEL and teaching environments.

In a project that uses TEL to support teaching and learning, the Learning to Teach Online project successfully used a range of online resources as catalysts for engagement and was able to see their effectiveness in the resulting Twitter and blog activity (McIntyre 2011). TEL can be used as a means of closing the attainment gap in education (Becker, Cummins, Davis, Freeman, et. al., 2017). Now we look at smart learning environments and how they can impact teaching and learning in schools.

## 2.4 Smart Learning Environments

The traditional learning paradigm has been criticised for being too artificial, rigid and unresponsive to the needs of today's society (Kinshuk & Graf 2012). On the other hand, most students today are digital natives, who have been immersed in the use of smart mobile devices and digital resources for communications, learning, and entertainment in everyday life (Bennett et al. 2008; Gu, Zhu, & Guo, 2013; Yong, Gates & Harrison, 2016).

Koper (2014) proposed that smart learning environments (SLEs) are defined as physical environments that are enriched with digital, context-aware and adaptive devices, to promote better and faster learning. The term 'smart' has been used to modify a learning environment as well as a technology. A learning environment therefore includes technology (Spector, 2016). Hwang (2014); Zhu, Yu & Riezebos, 2016 elaborated that the potential criteria of a smart learning environment include context-aware, able to offer instant and adaptive support to learners, and able to adapt the learner interface and subject contents. Smart learning environment not only enables learners to access ubiquitous resources and interact with learning systems anytime and anywhere, but also provides the necessary learning guidance, suggestions or supportive tools to them in the right form, at the right time and in the right place. Supportive tools or smart devices refer to artefacts that exhibit some properties of ubiquitous computing, including (although not necessarily) artificial intelligence; for instance, the Internet of things, wearable technology in the form of an accessory such as glasses, a backpack, or even clothing (Gros, 2016).

Smart learning environments supported by technologies should not only enable learners to digital resources and interact with the learning systems in any place and at any

time, but also actively provides them with the necessary learning guidance, supportive tools or learning suggestions in the right place, at the right time, and in the right form (Hwang 2014). Teachers therefore should be trained or equipped with skills and knowledge on designing and applying SLEs in their classrooms. This suggestion is supported by Ha & Lee, (2019, p1.) where they assert that teacher competencies are regarded as a critical factor in the successful implementation of smart learning. Smart learning is not just learning with smart devices but the learning that smart technology can afford. We now focus on constructivist pedagogy and how it can be used to train teachers in the use of technologies.

## 2.5 Constructivist Pedagogy

In its very simple definition, constructivism is a theory of learning or theory of knowledge (epistemology) which states that humans generate knowledge and meaning from experiences and interactions (Moore, 2004). Constructivists believe that humans construct their own knowledge and understanding through ideas, content, events, etc. that they come in contact with (McPherson & Nunes, 2004; Moore, 2004). Constructivism is an active learning process in which meaning is developed based on experience and inquiry (McPherson & Nunes, 2004). Essentially, it is a meaning-centred approach to both teaching and learning. It emphasises the learner's role in constructing meaning – as opposed to the simple and traditional transmission from the lecturer/teacher to student.

It is an approach to teaching and learning based on the premise that cognition (learning) is the result of mental construction. In other words, students learn by fitting new information together with what they already know. Constructivists believe that learning is affected by the context in which an idea is taught as well as by students' beliefs and attitudes (Bada, 2015). According to Piaget (1970), constructivism is whereby humans generate knowledge and meaning from building and connecting prior knowledge to new conceptual frameworks. This theory is used extensively in education field in order to obtain the most appropriate techniques in teaching and learning (Sjøberg, 2007).

According to Bada (2015), an important restriction of education is that teachers cannot simply transmit knowledge to students, but students need to actively construct knowledge in their own minds. That is, they discover and transform information, check new information against old, and revise rules when they do no longer apply. Therefore, when it comes to teaching and learning, constructivist followed instruction requires strong respectful relationships and safe learning environments, especially as teacher-student relationships shift from expert-disciple towards peer-based collaborative learning (Taylor & Parsons, 2011). We now look at the methodology used in the study.

### 3. Methodology

This study used the positivism and interpretive paradigms with mixed methods approach in a case study design. Positivists relate on the importance of what is given with more strict focus to consider pure data as well as facts without being influenced by interpretation of bias of human (Scotland, 2012; Saunders, Lewis & Thornhill, 2012). In addition, positivists consider that only the knowledge confirmed by the senses is affirmed as knowledge (Bryman, 2012). It follows the objective route in research and advocates that knowledge is gained through a gathering of objectively verifiable facts using quantitative means. On the other hand, the interpretive paradigm is concerned with understanding the world as it is from subjective experiences of individuals. According to Willis (2007), interpretivism usually seeks to understand a particular context, and the core belief of the paradigm is that reality is socially constructed. Interpretivist researchers understand “*the world of human experience*” (Cohen & Manion, 1994: p36). Consistent with Cohen and Manion’s view, Creswell (2003), Yanow & Schwartz-Shea (2011) claim that interpretivist researchers discover reality through participant’s views, their own background and experiences.

A mixed method research design was used whereby participants responded to an online questionnaire that had both closed and open-ended questions. Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration (Johnson, Onwuegbuzie & Turner 2007, p. 123).

#### 3.1 Sampling, Instrument and Procedure

A convenient sampling technique was used whereby all participants in the PGCE class were selected. Convenience sampling is a type of nonprobability sampling where members of the target population that meet certain practical criteria are included for the purpose of the study (Dörnyei, 2007). Criteria may include easy accessibility, geographical proximity,

availability at a given time, or the willingness to participate. In this study, students in a Post Graduate Certificate in Education (PGCE) class enrolled with Institute of Distance Education (IDE) formed the sample. All 114 PGCE students in the class were taken as the number was manageable based on the instrument used and data analysis.

Upon completion of the semester course, a link to the online questionnaire was placed in the Moodle LMS where the students took an online course (Technology and Skills in Education). Students were given instructions on how to access the link and were requested to respond to the questionnaire on the study which gauged their level of understanding of instructional media and technologies used in teaching and learning. At the completion of the questionnaire, students were asked to click “**Submit**” to finish. The responses were saved on “**Google Forms**” and the researcher downloaded them as an Excel File.

#### 3.2 Data Analysis

Data analysis is the process of organization, manipulation and consideration of the meaning of data collected (Kothari, 2017). Since the study used a mixed method approach, Google form was used to analyse the quantitative data that comprised of closed ended questions. Graphs and charts were created from the results. Qualitative data were analysed through thematic analysis. This approach strives to identify patterns of themes generated from the collected data (Braun, Clarke, Hayfield & Terry, 2019; Huberman & Miles, 2019). Open-ended questions were put into themes, and presented in narrative form.

### 4. Results and Discussion

Results of the study are reported based on the two objectives. The main idea of the study was to identify knowledge levels on the use of technologies and skills as well as preferred technologies in online learning environments.

**Objective 1:** To identify knowledge levels of PGCE students on the application of educational technology and skills used in teaching and learning.

A number of questions were asked for the participants to respond. Below are results followed by discussion. Participants were asked what educational technology is:

Educational Technology is all components of informational technology that are used to deliver educational materials.

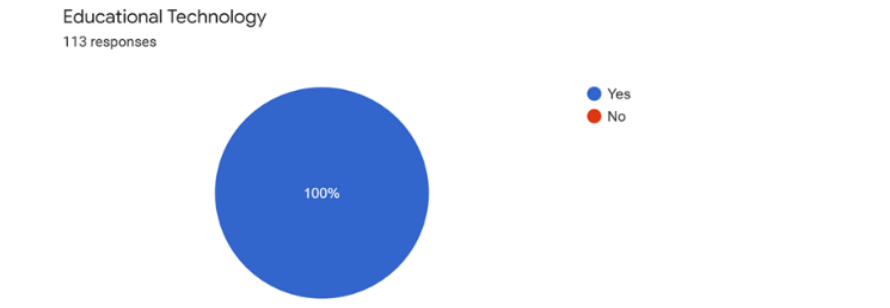


Figure 1: Meaning of Educational Technology

Figure 1 above indicates that participants 113 (100%) of those who responded to the question were quite familiar with educational technologies as all components of informational technology that are used to deliver

educational materials. A follow-up question was asked to gauge their understanding of Educational Technologies. From a list of different technologies, participants were asked to spot which were not educational technologies.

The following is not an Educational Technology

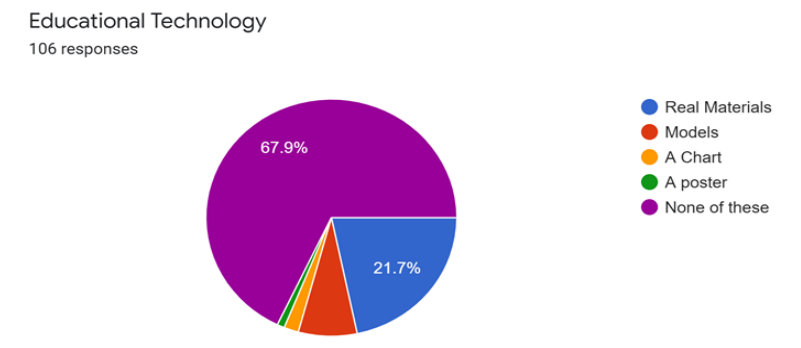


Figure 2: What is not an educational technology

Figure 2 above indicates that 67.9% said real materials, models; charts and posters were all educational technologies. A significant number (21.7%) indicated that real materials were not educational technologies. A few others felt that models, charts and posters were not educational technologies. Perhaps we can assume here that some participants feel that a technology has to be a machine or gadget of some sort.

To gauge their familiarity with the different tools they use or would use in the teaching and facilitation of

learners, participants were asked to indicate (via a tick) on their familiarity of different technologies. Figure 3 below shows that 105 (97.2%) were familiar with posters followed by Facebook (101) 93.5% and White Board (98) 90.7%. The list media/materials selected were Realia (Real Media) where only 4 (3.7%) indicated to be familiar with it. It can also be assumed that the term "Realia" could have confused some of them. This result (realia) tallies well with the previous question where 21.7% of the respondents said real materials are not media.

I am familiar with the following media/Instructional technologies (Tick as many).

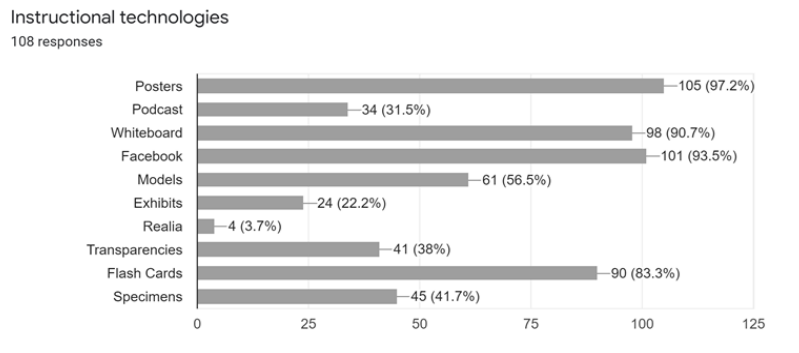


Figure 3: Familiarity with instructional media/technologies

Participants were also asked to rate the knowledge and/or skill in using the Over-Head Projector (OHP). The result indicated that 36 (34.3%) fairly knew or have used the OHP. Only 12 (11.4%) were confident with the OHP. While it is an old technology, it still exists in many

schools, as the computer projector is still expensive for many schools to afford. This notion is corroborated by Naik, Chitre, Bhalla & Rajan, (2020); Sharpe, Patalay, Choo, Wall, et. al., (2018); Sife, Lwoga & Sanga, (2007). See figure 4 below.

Rate your knowledge/skill on the use of an Over Head Projector

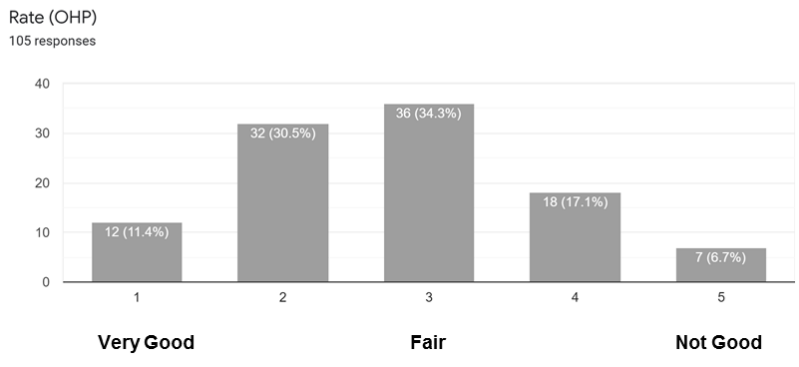


Figure 4: Knowledge/skill in using the OHP

In relation to the OHP above, the researcher asked the participants on their knowledge and/or skill in using the multi-media projector or commonly known as the computer projector. Figure 5 below shows that 20 (19.4%) never used it while 16 (15.5%) said were very good at using the technology. The majority of the

participants fell in the lower level of being fair (24) 23.3% followed by fair (23) 22.3%. The result shows that there needs to be more exposure on the use of the multi-media projector as it is very handy to use compared to the Over Head Projector which cannot be connected to a computer or other gadgets.

**Rate your knowledge/Skill on the use of the Multimedia projector.**

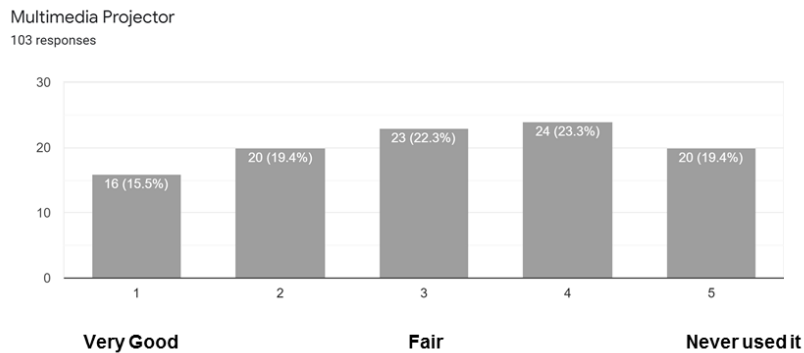


Figure 5: Knowledge/skill in using the MM Projector

While some participants were well versed with the multi-media projector, participants were asked to respond on what multi-media means in their understanding. The majority (88.7% demonstrated understanding as they selected “two or more medias integrated in a single platform” as multi-media. The response was correct.

Some (8.2%) indicated that it was two medias used as the same time while less participants indicated multi-media as a laptop, PPT projector and OHP. The response however shows good understanding of multi-media. Figure 6 below shows the result.

**Multimedia refers to:**

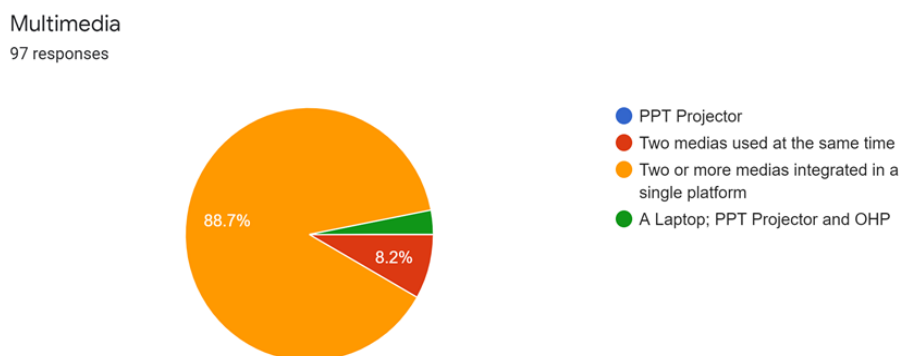


Figure 6: What does multi-media refer to?

The researcher wanted to gauge the participants’ skill in the creation/development and use of selected key technologies. These were Video Clips or video shows and PowerPoint Presentation. Teachers and facilitators currently use these technologies extensively, especially in the era of online learning. Many clips of choice exist for teachers and facilitators to select and use suitable

ones for their classes. YouTube is a large source of clips but one can create own clips. PPTs are easily created and used by teachers and facilitators. A key question asked was to gauge the advantage/s of video over other technologies. Figure 7 below gives participants’ opinions on the advantages of video over other media.



## What makes a video show to have an advantage over other projected media?

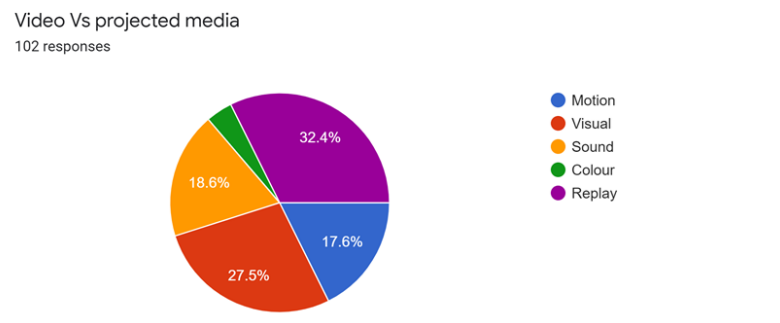


Figure 7: Advantages of video over other projected media.

Figure 7 above indicates that the capability of videos to be replayed has greater advantage over other technologies as 32.4% participants chose it. The visual capability (27.5%) was next followed by sound (18.6%). Motion was the least (17.6%) followed by colour as the lowest advantage. While there is separation on the different attributes of video, a combination of the whole gives it a greater advantage. As an example, colour could be important where one needs to make a distinction between different colours in a given video clip. The

above result is supported by Wang (2015) who reports that videos can provide information for listeners and can keep them attentive and focused on the aural material. In addition, video is a comprehensive method of teaching. The combined use of speech, text and visuals allows the teacher to get to the heart of the matter more quickly than traditional teaching allows (Nematova, 2022). The next figure shows participants' experience in using PowerPoint Presentation.

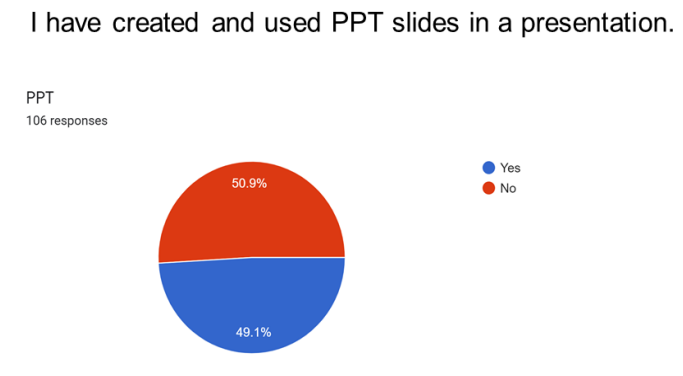


Figure 8: Experience in using PPT presentation.

Participants were asked whether they have created and used PPT slides in a presentation. Figure 8 above reveals an almost 50/50 response whereby 50.9% indicated to have not used it while 49.1% said yes. The result indicates that more needs to be done so that more teachers are skilled in the use of this key technology. With the advent of technology in the era of online learning, there may be some misconception on the understanding of the different terms or concepts used by teachers and facilitators. The researcher wanted to find out the level of understanding of Information Technology (IT); Instructional Technology (another IT) and Information Communication Technology (ICT).

Participants were asked whether information technology is the same as instructional technology. Figure 9 below indicate that the majority (60.5%) thought it was the same while 39.5% said no. While there is some relationship between the two, instructional technology (just like educational technology) encompasses all the media and materials that teachers and facilitators use when conducting lessons. On the other hand, information technology leans more towards gadgets and/or software that are mostly used to process information (e.g., computers).

Information Technology is the same as Instructional Technology.

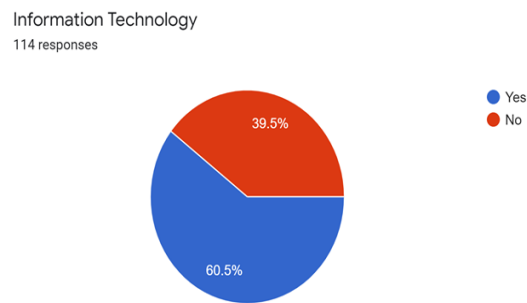


Figure 9: Is information technology the same as instructional technology?

In order to clearly show their understanding of the above concepts (Instructional Technology and Information technology), participants were asked to agree on what Information Communication Technology (ICTs) are. As shown in figure 10 below, 97% agreed that ICTs are a combination of hardware, software and the means of

production that enables the exchange, processing and management of information and knowledge. This is key since teachers use ICTs in their preparation of teaching and learning materials as well as the actual delivery of instruction.

ICT is the combination of hardware, software and the means of production that enable the exchange, processing and management of information and knowledge.

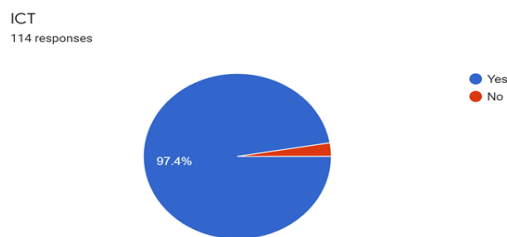


Figure 10: What is Information Communication Technology?

Traditionally, blackboards have been used in the classroom. Trends have changed where some boards are green and others are white or commonly known as whiteboards. While chalk is used on the black and green boards, whiteboard markers (non-permanent) are used for whiteboards.

A newer board used in schools today is the interactive whiteboard. This technology is different from the normal whiteboard as it is smart since it is computer driven. Participants were asked whether the whiteboard is the same as the interactive whiteboard.

Is the Whiteboard the same as an Interactive Whiteboard?

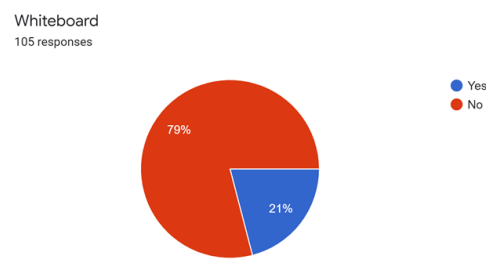


Figure 11: Whiteboard same as interactive whiteboard.

The majority (79%) indicated that it is not the same while the rest (21%) felt it was the same. The result shows that more participants were current with new technologies. This is shown in figure 11 above. The researcher was interested to find out how much the participants are

knowledgeable about *social media*. This technology is used extensively in education nowadays. Teachers use it for leisure, some use it to extend education and knowledge to learners (Powers & Green, 2016; Van Den Beemt, Thurlings & Willems, 2020).

Table 1: What is social media?

| Briefly discuss what Social Media is.  |  |
|--|--|
| <ul style="list-style-type: none"> <li>Social media is the social interaction among people in which they create, share or exchange information, ideas, and pictures/videos in virtual communities and networks.</li> </ul> |  |
| <ul style="list-style-type: none"> <li>Internet based form of communication, which allows users to have conversations, share information and create web content.</li> </ul>  |  |
| <ul style="list-style-type: none"> <li>It is a media where people communicate through the internet and response is immediate. Examples are; Facebook, WhatsApp, skype, etc.</li> </ul>                                     |  |

Participants were asked what social media was. Their responses are as shown in table 1 above. Responses from the participants shows good understanding of what social media is.

To find out more about social media, the participants were asked to indicate which characteristics *do not* make social media to be what it is. The choices given were 1)

immediacy, 2) interaction and 3) user controlled. All of these are key characteristics of social media. There is immediacy when interacting; interaction is key as well as user controlled. Some participants felt the above were not characteristics of social media as shown in figure 12 below. Key however was 65.7% who selected *none of these*. The result shows that while many use social media, some do not know of the key characteristics

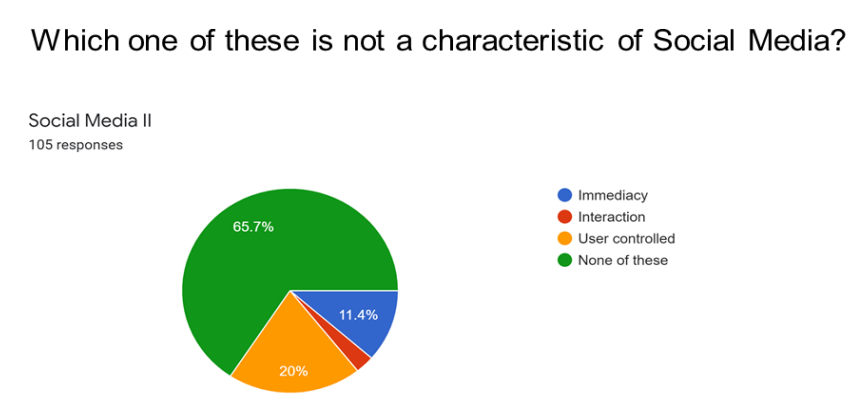


Figure 12: Not a characteristic of social media.

The researcher wanted to link between the use of social media and knowledge construction. Learning has become more collaborative and sharing of information and knowledge due to availability of tools and resources. Participants were asked to indicate which media were most suitable where learners construct their own

knowledge and share experiences. The majority selected social media (73.5%) while some chose other media as shown in figure 13 below. As already mentioned above, social media is useful for knowledge creation and sharing.

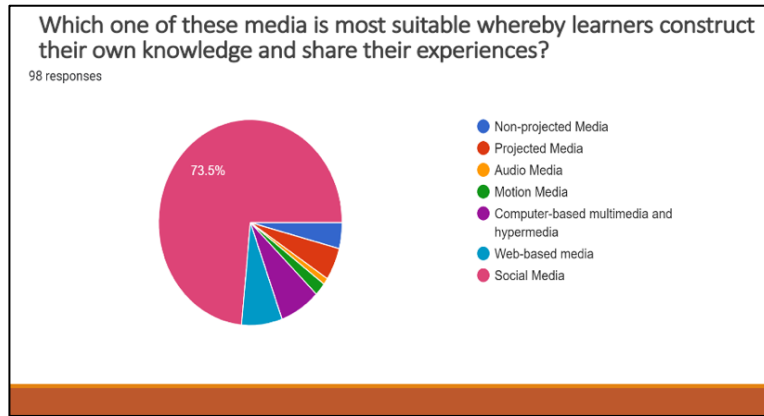


Figure 13: Suitable media for constructing and sharing knowledge.

**Objective 2:** To establish better ways of delivering the course to training prospective teachers in online learning environments.

During the past Covid-19 pandemic, the way instruction was delivered and how learners interacted with the learning materials changed dramatically. Many institutions were closed, schools were closed and teaching and learning had to be carried out from home. There was not enough time for preparation on the teacher/facilitator side as well as the learners.

At the University Eswatini, staff and students were not spared. The researcher therefore wanted to establish better ways of delivering the skills and technology course for post-graduate students (PGCE) in online environments. Participants were asked to rate their use of mobile devices to access online course materials. Almost all the participants (92.6%) said yes on the use of mobile devices while only 7.4% said no. This is shown in figure 14 below.

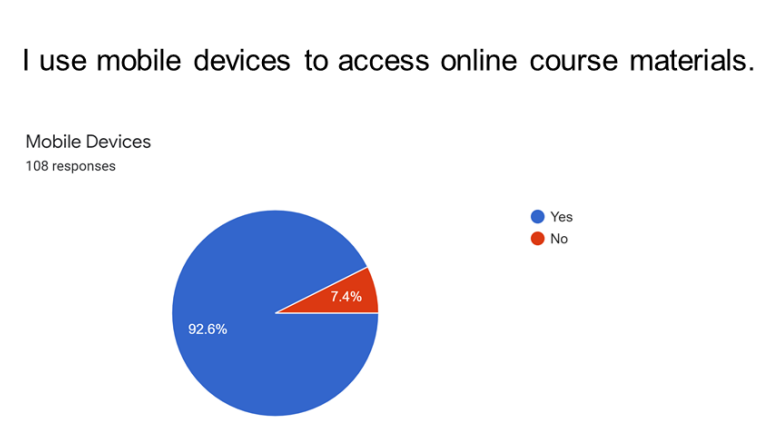


Figure 14: Use of mobile devices.

Since Moodle was the main platform used by the university for online learning, participants were asked to rate their experience in using the platform for accessing learning materials. The results in figure 15 show that 52.8% were very confident in using Moodle followed by

34.3% who were confident in using it. 11.1% were fairly confident while the remainder were either less confident or did not like using it. More needs to be done to build more confidence for the learners.

## Rate your experience in using Moodle (E-learning)

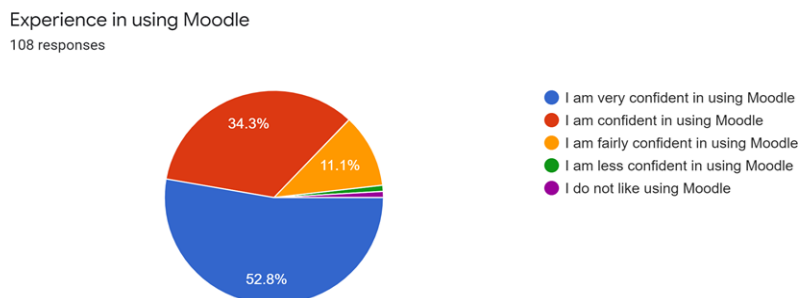


Figure 15: Experience in using Moodle.

Below are general experiences which have been themed from the different responses of the participants. Specific skill or experience related questions were asked.

Table 2: Gaining of Skill.

As a practicing or prospective teacher, describe how you have gained in terms of skill acquisition after taking the course.

- Learnt how to integrate technology into my lesson.
- Have gained a lot like creating and using of a blog, google classroom. This course has also made me confident in incorporating media in my teaching although some are still not available like the OHP.
- Has enabled me to understand how online teaching can be made possible and easy.
- I have gained a lot of knowledge in this course as I learnt how to incorporate technology in the teaching and learning process, for effective teaching.

Table 3: Gaining of skill II

As a practicing or prospective teacher, describe how you have gained in terms of skill acquisition after taking the course.

- This course has equipped me with skill to create my own materials using technology as well as managing an online class.
- I learnt how to combine media to make the lesson interesting and meaningful. Learner centred methodology can be much easier.
- I have learnt how to prepare and use teaching media to enhance teaching and learning in my classes.
- I gained a lot of skills which I am now using to teach.

Tables 2 and table 3 above show selected responses on how participants gained after taking the course. In general, having used Moodle and other platforms such as Google Classroom has helped the participants to gain more skill and knowledge in the use of technology.

In table 4 below, participants were asked to indicate which technologies they preferred to use in online learning environments. Google class, WhatsApp,

Table 4

Which technologies do you prefer to use as a teacher in online learning environments?

- Google classroom, WhatsApp, Facebook
- Moodle
- I prefer using online learning because it is mostly safe.
- Computer, cell phone, Internet.
- Videos and slides.
- Radio Lessons.

Facebook and Moodle were mentioned. Others preferred the use of computers, cell phones, Internet, videos and slides. Radio was also mentioned as some lessons took place via radio. In addition, the researcher wanted to find out shortcomings that participants encountered when taking the course. Table 5 on the right gives a few selected shortcomings. In general, issues of data, network issues as well as some skill related issues.

Table 5

List any shortcomings you encountered when taking this course.

- Shortage of data so that we could download content.
- Data is expensive.
- There were a few challenges we met along the way but worth noting was the group work which was a bit of an impossible thing to get to meet as a group and others wouldn't even observe meeting time online.
- Network poor performance.
- Lack of some computer skill like power point.
- Creating a blog and preparing a lesson plan which includes different media.

Participants were also asked to give suggestions in the running of the course for improvement purposes. Table 6 and 7 below give a few selected suggestions. Some

suggestions (like free tablets, providing teachers with computers and data) all depend on the availability of funds.

Table 6

|  |
|--|
| <p>Any suggestions in improving the running of the course so as to address the technological gap/s experienced by teachers or prospective teachers?</p> <ul style="list-style-type: none"> <li>• Have all student receive free tablets for learning.</li> <li>• Provide teachers with computers and data.</li> <li>• Suggest tablets should be part of the requirements so that we get to practice this things in practice.</li> <li>• Introducing ICT at earlier grades in school.</li> <li>• Sticking to one online platform would help, instead of mixing more than one platform like Google classroom and Moodle.</li> </ul> |
|--|

Table 7

|  |
|--|
| <p>Any suggestions in improving the running of the course so as to address the technological gap/s experienced by teachers or prospective teachers?</p> <ul style="list-style-type: none"> <li>• Have all student receive free tablets for learning.</li> <li>• Provide teachers with computers and data.</li> <li>• Suggest tablets should be part of the requirements so that we get to practice this things in practice.</li> <li>• Introducing ICT at earlier grades in school.</li> <li>• Sticking to one online platform would help, instead of mixing more than one platform like Google classroom and Moodle.</li> </ul> |
|--|

Participants were also asked to give any other comments or suggestions about the course. Table 8 below gives

some of the comments. Key is having the course to be more practical than it is now.

Table 8

|  |
|--|
| <p>Any other comments/Suggestions?</p> <ul style="list-style-type: none"> <li>• The course should be more practical than theory hence the suggestion of each student having his own tablet</li> <li>• I loved and enjoyed this course, it was just a wonderful experience for me.</li> <li>• The course was very much interesting and fulfilling to me.</li> <li>• This is a very informative and helpful course.</li> <li>• Have proper gadgets.</li> <li>• The course is helpful especially based on what we went through during Covid.</li> </ul> |
|--|

## Discussion

The results of the study agree with views of constructivists who believe that learning is affected by the context in which an idea is taught as well as by students' beliefs and attitudes (Bada, 2015; Sjøberg, 2007). Students' beliefs and attitudes determined their interest in learning about technologies used in teaching and learning.

From the results, the use of smart learning environments (such as the online learning platforms), are in line with Ha & Lee, (2019); Hwang (2014) who said technologies should not only enable learners to access digital resources but should allow learners to interact with the learning systems in any place and at any time, but also actively provide them with the necessary learning guidance and supportive tools.

As noted by Daniela, et al., (2018); Weller, (2011), new technologies and ICTs have the potential to reshape all scholarly areas. The results also indicate that Technology Enhanced Learning Environments (TELEs) leads to an assumption that a students' familiarity with technology can impact on learning success. A number of students acknowledged being able to apply what they have learnt based on the application of technologies. Challenges faced by the participants tally with what Chatti et al. (2010) summarised in their article that the future challenges in education are fundamentally personal, social, distributed, ubiquitous, flexible, dynamic and complex in nature. While technological challenges were

outstanding, personal and social challenges have impact on student learning.

## 5. Conclusion and Recommendations

### 5.1 Conclusion

1. The study looked at the contribution and importance of educational technologies as tools to facilitate efficient teaching and learning in schools by PGCE students in online learning environments.
2. The results indicate that the students are familiar with online technologies and social media platforms, which they can use for conducting online lessons.
3. Lack of more practical skills in using technology and challenges of Internet and connectivity were revealed.

### 5.2 Recommendations

1. It is recommended that prospective teachers be exposed to more instructional/media technologies used in the classroom.
2. While it was not the scope of this study, the inclusion of assistive technologies for students with disabilities should form part of their training.

- The way in which the current PGCE students are facilitated needs to be reviewed to include more practical components in terms of using ICTs and media technology.

## References

- Adesote, S.A. & Fatoki, O.R. (2013). "The Role of ICT in the Teaching and Learning of History in the 21st Century". *Academic Journals. Educational Research and Reviews*, 8 (21), 2155-2159
- Aleven, V., Stahl, E., Schworm, S., Fischer, F., & Wallace, R. (2003). Help seeking and help design in interactive learning environments. *Review of Educational Research*, 73(3), 277-320.
- Al Hamdani, D.S. (2014). "A Constructivist Approach to a Mobile Learning Environment," *International Journal of Computer Applications*, 93 (4).
- Bada, S.O. (2015). Constructivism Learning Theory: A Paradigm for Teaching and Learning. *IOSR Journal of Research & Method in Education (IOSR-JRME)* e-ISSN: 2320-7388, p-ISSN: 2320-737X V 5 (6) Ver. I (Nov. - Dec. 2015), 66-70 [www.iosrjournals.org](http://www.iosrjournals.org)
- Becker, S. A., Cummins, M., Davis, A., Freeman, A., Hall, C. G., & Ananthanarayanan, V. (2017). *NMC horizon report: 2017 higher education edition*. 1-60. The New Media Consortium.
- Bennett, S., Maton, K. & Kervin, L. (2008). The 'digital natives' debate: a critical review of the evidence. *British Journal of Educational Technology*. 39(5), 775-786.
- Beetham, H. & Sharpe, R. (2013). *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning*. 2nd ed., Routledge, New York.
- Braun, V., Clarke, V., Hayfield, N. and Terry, G. (2019). Thematic analysis, in Liamputtong, P. (Ed.), *Handbook of Research Methods in Health Social Sciences*, Springer Nature Pte, Singapore, 843-860.
- Bruce, B. C., & Levin, J. A. (1997). Educational technology: Media for inquiry, communication, construction, and expression. *Journal of educational computing research*, 17(1), 79-102.
- Bryman, A. (2012). *Social research methods* (4th ed.). Oxford university press.
- Burke, J.R., Onwuegbuzie, A.J. & Turner, L.A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research* 1:112-133.
- Chatti, M. A., Agustiawan, M. R., Jarke, M., & Specht, M. (2010). Toward a personal learning environment framework. *International Journal of Virtual and Personal Learning Environments (IJVPLE)*, 1(4), 66-85.
- Chukwu, E. O. (2011). Knowledge and use of Information and Communications Technologies (ICTS) in Teaching and Learning among Teachers and Students of Schools of Nursing and Midwifery in Benue State, Nigeria.
- Cohen, L., & Manion, L. (Eds.). (1994). *Research methods in education* (4th ed. ed.). London: Longman.
- Creswell, J. W. (Ed.). (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*. (2nd ed. ed.). Thousand Oaks: Sage.
- Daniel, J. (2012). Making sense of MOOCs: Musings in a maze of myth, paradox and possibility. *Journal of interactive Media in education*, 3.
- Daniela, L., Visvizi, A., Gutiérrez-Braojos, C., & Lytras, M. D. (2018). Sustainable higher education and technology-enhanced learning (TEL). *Sustainability*, 10(11), 3883.
- Dörnyei, Z. (2007). *Research methods in applied linguistics*. New York: Oxford University Press.
- Ellis, R.A., Goodyear, P., Calvo, R.A. & Prosser, M. (2008). 'Engineering students' conceptions of and approaches to learning through discussions in face-to-face and online contexts'. *Learning and Instruction*. 18(3):267-282
- Gu, X., Zhu, Y., & Guo, X. (2013). Meeting the "digital natives": Understanding the acceptance of technology in classrooms. *Journal of Educational Technology & Society*, 16(1), 392-402.
- Goodman, S. (2003). *Teaching youth media: A critical guide to literacy, video production and social change*. Teachers College Press, New York.
- Gros, B. (2016). The design of smart educational environments. *Smart learning environments*, 3, 1-11.
- Ha, C., & Lee, S. Y. (2019). Elementary teachers' beliefs and perspectives related to smart learning in South Korea. *Smart Learning Environments*, 6(1), 3.
- Hannafin, M.J. & Land, M.S. (2004). *The foundations and assumptions of technology-enhanced student-centered learning environments: Instructional Science*: Springer Rotterdam.
- Hannafin, M. J., & Hannafin, K. M. (2010). Cognition and student-centered, web-based learning: Issues and implications for research and theory. *Learning and instruction in the digital age*, 11-23.
- Herold, B. (2015). Why Ed Tech is not transforming how teachers teach. *Education Week* (June 10). Retrieved from <https://www.edweek.org/ew/articles/2015/06/11/why-ed-tech-is-nottransforming-how.html>
- Huberman, A. M., & Miles, J. S. M. B. (2019). *Qualitative data analysis: A methods sourcebook*.

- Hwang, G.J. (2014). Definition, framework and research issues of smart learning environments-a context-aware ubiquitous learning perspective. *Smart Learning Environments* 1(1), 1–14
- Ithigise, A. E., & Wordu, N. C. (2018). Educational technology: Catalyst to quality teaching and learning. *Knowledge Review*, 37(2), 71-81.
- Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of mixed methods research*, 1(2), 112-133.
- Kothari, C. (2017). research methodology methods and techniques by CR Kothari. *Published by New Age International (P) Ltd., Publishers*, 91.
- Kim, M.C. & Hannafin, M.J. (2011) Scaffolding problem solving in technology-enhanced learning environments (TELEs): Bridging research and theory with practice. *Computers & Education*, 56, 403-417.
- Kinshuk, S. & Graf, S. (2012). *Ubiquitous Learning*. Springer Press, Berlin Heidelberg New York.
- Kirkwood, A. and Price, L. (2014). Technology-enhanced learning and teaching in higher education: what is ‘enhanced’ and how do we know? A critical literature review. *Learning, Media and Technology*, 39(1) 6–36.
- Koper, R. (2014). Conditions for effective smart learning environments. *Smart Learning Environments* 1(1), 1–17.
- Land, S. M. (2000). Cognitive requirements for learning with open-ended learning environment. *Educational Technology Research and Development*, 48(3), 61-78
- Laurillard, D., Balacheff, N., Ludvigsen, De Jong, T., Lazonder, A. & Barnes, S. (2009). ‘Implementing technology-enhanced learning’, in *Technology Enhanced Learning*, eds., Springer, Dordrecht, The Netherlands, pp. 289306.
- Lee, J., & Choi, H. (2017). What affects learner’s higher-order thinking in technology-enhanced learning environments? The effects of learner factors. *Computers & Education*. 115, 143–152.
- Lwoga, E. (2012). Making learning and Web 2.0 technologies work for higher learning institutions in Africa. *Campus-Wide Information Systems*, 29(2), 90-107. <http://doi.org/10.1108/10650741211212359>
- Margaret R. (2016). *ICT (information and communication technology or technologies)*. Available: [www.searchcio.techtarget.com/definition/ICT-information-and-communications-technologor-technologies](http://www.searchcio.techtarget.com/definition/ICT-information-and-communications-technologor-technologies).
- McIntyre, S. (2011). *Learning to Teach Online: Developing High Quality Video and Text Resources to Help Educators Teach Online*, Australian learning and Teaching Council, Sydney.
- McPherson, M. & Nunes M. B (2004). *Developing innovation in Online Learning – an action research framework*. Routledge Falmer, London.
- Meyer, B.B. & Latham, N. (2008). Implementing electronic portfolios: benefits, challenges, and suggestions. *EDUCAUSE Q.* 31(1), 34–41.
- MOET (2018). <https://www.unicef.org/eswatini/media/336/file/UNI-CEF-SD-Education-Sector-Policy-report-2018.pdf>
- Moore, K.C., (2004), “*Constructivism & Metacognition*”. [Online]. Available: <http://www.tier1performance.com/Articles/Constructivism.pdf>
- Mtebe, J. S., Mbwilo, B., & Kissaka, M. M. (2016). Factors influencing teachers’ use of multimedia enhanced content in secondary schools in Tanzania. *International Review of Research in Open and Distributed Learning*, 17(2), 65–84.
- Mtebe, J.S. and Raphael, C. (2017). Pre-Service Teachers' Self-Efficacy Beliefs towards Educational Technologies Integration in Tanzania. *Journal of Learning for Development*, 4 (2) 196-210.
- Naik, G., Chitre, C., Bhalla, M., & Rajan, J. (2020). Impact of use of technology on student learning outcomes: Evidence from a large-scale experiment in India. *World Development*, 127, 104736.
- Nematova, Z. (2022). Advantages of using videos in English lessons. *International Bulletin of Applied Science and Technology*, 2(9), 8-12.
- Nor-Ul-Amin, S. (2014). *An Effective use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research, and Experience: ICT as a Change Agent for Education (A literature Review)*. Available: [www.ngu.edu/classes/keefers/waoc/armins.pdf](http://www.ngu.edu/classes/keefers/waoc/armins.pdf).
- Oikonomou, V.L. & Patsala, P. (2021). *The Integration of Educational Technologies in Foreign Language Education: Teacher Practices and Attitudes in Greece* (CITY College, International Faculty of the University of Sheffield, Greece).
- Piaget J. (1970). *Science of education and the psychology of the child*. New York, Orion.
- Powers, K., & Green, M. (2016). Principals’ perspectives on social media in schools. *The Journal of Social Media in Society*, 5(2), 134-168.
- Sánchez, Castro J. J. and Alemán, E. C. (2011). Teachers’ opinion survey on the use of ICT tools to support attendance-based teaching. *Journal Computers and Education*, 56, 911-915.
- Saunders, M., Lewis, P. & Thornhill, A. (2012). *Research Methods for Business Students*. 6th edition, Pearson Education Limited.



- Scotland, J. (2012). Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms. *English Language Teaching*, 5(9), pp.9-16
- Shapiro, W.L., & Roskos, K. (1995). Technology-enhanced learning environments. *Change*, 27(6), 67-69.
- Shan.Jo Fu (2013). ICT in Education: A Critical Literature Review and Its Implications. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 2013, 9(1), 112-125.
- Sharpe, H., Patalay, P., Choo, T. H., Wall, M., Mason, S. M., Goldschmidt, A. B., & Neumark-Sztainer, D. (2018). Bidirectional associations between body dissatisfaction and depressive symptoms from adolescence through early adulthood. *Development and psychopathology*, 30(4), 1447-1458.
- Shin, S., Brush, T., Glazewski, K. (2017). Designing and Implementing Web-based Scaffolding Tools for Technology-Enhanced Socioscientific Inquiry. *Educational Technology & Society*, 20(1), 1–12.1
- Shyamal, M. (2015). *Emerging Trends in ICT for Education and Training*. Available: [www.unevoc.unesco.org/.../emergingtrendsinctforeducation](http://www.unevoc.unesco.org/.../emergingtrendsinctforeducation).
- Sife, A., Lwoga, E., & Sanga, C. (2007). New technologies for teaching and learning: Challenges for higher learning institutions in developing countries. *International journal of education and development using ICT*, 3(2), 57-67.
- Sjøberg, S., (2007), "Constructivism and learning". [Online]. Available: [http://folk.uio.no/sveinsj/Constructivism\\_and\\_learning\\_Sjoberg.pdf](http://folk.uio.no/sveinsj/Constructivism_and_learning_Sjoberg.pdf).
- Smith, C., Onofre-Martínez, K., Contrino, M. F., & Membrillo-Hernández, J. (2021). Course design process in a technology-enhanced learning environment. *Computers & Electrical Engineering*, 93, 107263.
- Sorin, B. and Armenia, A. (2017). The International Scientific Conference eLearning and Software for Education; Bucharest, 2. DOI:10.12753/2066-026X-17-090
- Spector, J. M. (2016, March). Smart learning environments: Concepts and issues. In *Society for Information Technology & teacher education international conference* (pp. 2728-2737). Association for the Advancement of Computing in Education (AACE).
- Taylor, L. & Parsons, J. (2011). Improving Student Engagement. *Current Issues in Education*, 14(1). Retrieved from <http://cie.asu.edu/>
- Tinio, L. (2003). *ICT in Education* (pp. 4-11, 21-24). United Nations Development Programme. Bureau for Development Policy, New York. Retrieved May 23, 2008, from <http://www.apdip.net/publications/iespprimers/epri-mer-edu.pdf>
- Van Den Beemt, A., Thurlings, M., & Willems, M. (2020). Towards an understanding of social media use in the classroom: a literature review. *Technology, Pedagogy and Education*, 29(1), 35-55.
- Wang, Q. (2008). A generic model for guiding the integration of ICT into teaching and learning, *Innovations in Education and Teaching International*, 45(4), 411419.
- Wang, Z. (2015). An analysis on the use of video materials in college English teaching in China. *International Journal of English Language Teaching*, 2(1), 23-28.
- Weller, M. (2011). A pedagogy of abundance, *Spanish Journal of Pedagogy*, 249, pp. 223236.
- Willis, J. W. (2007). *Foundations of qualitative research: interpretive and critical approaches*. London: Sage.
- Witt, C. M., Trivedi, C., & Aminalroayae, F. (2021). Using flipped instruction in a technology-enhanced learning environment: the case for scaffolding. *Issues in Information Systems*, 22(2).
- Worldbank.org/en/country/eswatini/overview# (2023). Accessed on 8<sup>th</sup> October, 2023.
- Yanow, D., & Schwartz-Shea, P. (2011). *Interpretive Approaches to Research Design: Concepts and Processes*. Netherlands: Routledge.
- Yong, S. T., Gates, P., & Harrison, I. (2016). Digital native students—where is the evidence. *The Online Journal of New Horizons in Education*, 6(1), 46-58.
- Zhao, Y. & Bryant, F. L. (2006). Can teacher technology integration training alone lead to high levels of technology integration? A qualitative look at teachers' technology integration after state mandated technology training. *Electronic Journal for the Integration of Technology in Education*, 5, 53-62
- Zhu, Z, T., Yu, M.H & Riezebos, P. (2016). A research framework of smart education. *Smart Learning Environments*, 3(1), 1–17