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EXPLORING THE BENEFITS OF TECHNOLOGY INSTRUCTIONS IN ENGINEERING GRAPHICS AND DESIGN

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ABSTRACT

A qualitative case study was conducted to explore the benefits of technology instructions in engineering graphics and Design in Bohlabela secondary schools. The study was motivated by the increasing use of Information and Communications Technology (ICT) within the societal realm, which has led to an increase in the introduction of these ICT resources into the educational world. In this context, the ICT tool or the technology that the study spoke of is AutoCAD, which is a software that is used to draw in Engineering Graphics and Design (EGD). It is an excellent tool for collaborative learning and developing social skills that involve learners. Purposive sampling was employed to select 7 EGD teachers to partake in this study. Semi-structured interviews and classroom observations were used to collect data. Data gathered from interviews was subjected to thematic analysis, and data gathered from observations were reported descriptively. Despite certain obstacles, such as a lack of ICT resources, the study's findings discovered that EGD teachers in the Bohlabela District are prepared to integrate ICT into teaching and learning. They stated that integrating ICT into EGD lessons is crucial. The study suggests a course of action for policy, namely for curriculum writers to collaborate with EGD teachers to update the current curriculum with the inclusion of guidelines on when and where AutoCAD should be used. Due to financial constraints, the study recommends that the DBE grant AutoCAD licenses to all schools offering EGD.

Keywords: Engineering Graphics and Design, Information and Communication Technologies, AutoCAD, Spatial visualization

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INTRODUCTION

Engineering graphics and design play a crucial role in equipping learners with the necessary skills for engineering design and visualization. The AutoCAD program, a leading software in the field of computer-aided design, offers a wide range of features that can significantly enhance learners' learning experiences. This study aims to explore the benefits and pedagogical advantages of ICT to learners using AutoCAD. ICTs may be considered as a technical system with increased power and processing speed that facilitates changes in cognitive activities in a teaching-learning setting (Zavala, 2022). Therefore, based on the inputs we get and the level of assimilation we attain, every activity we perform causes different changes in our cognitive activity. As a result, when AutoCAD is used appropriately, the brain is subject to constant transformation and offers multiple opportunities to be modified by different experiences. ICT use suggests the potential for assimilation activities, in which each individual must discover their potential, come up with ideas, and plan them at their own pace. Teachers should take on the role of tutors, assisting learners with each task and utilizing AutoCAD as a tool to speed up learning, since it has been demonstrated that practical learning entices learning. Given the evidence that learners learn best by doing, educators should take on the role of tutors, assisting learners with each task while utilizing AutoCAD as a tool to speed up learning. The importance of identifying activities that could produce more meaningful stimuli in adaptive evolution should be emphasized, as classroom procedures aim to produce solid knowledge anchor points. Through interactive stimuli, AutoCAD serves as a bridge to the current generation, promoting skill acquisition. Consequently, it is anticipated that the adsorption and assimilation process will accelerate more significantly. One feature of a design process that speeds up the results is AutoCAD's ability to function as a catalyst. In addition, learning plasticity may also help accelerate the learning process. Based on those grounds, a study of this nature is timely. The main gaps that this study aimed to close was that many studies focused on challenges in integrating ICT like AutoCAD and fewer studies in the continent and none in South Africa, were on exploring the benefits of using AutoCAD.

PURPOSE

The purpose of the study is to explore the benefits of technology instruction in engineering graphics and Design classrooms.

RESEARCH QUESTIONS

The study sought to answer the following research questions:

1. How does the use of AutoCAD promote the teaching and learning of EGD in the classroom? (Interview)
2. To what extent is AutoCAD integrated into EGD classrooms? (Observation)

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LITERATURE REVIEW

Literature in modern education is the product of a significant pool of current scholarly work presented in a variety of formats such as articles, book chapters, dissertations, and many more. This allows academics to uncover knowledge gaps that may aid the development of the education field. However, this study's literature review will focus on these three points of focus:

1. Benefits of ICT in Classrooms
2. Factors that hinder the use of AutoCAD in the EGD classroom
3.

BENEFITS OF ICT IN CLASSROOMS

There are still lingering views that ICT is not beneficial to everyone, but this study argues that no matter the impact, it should be taught to learners in schools. Abraham and Otuaga (2017) state that the use of advanced ICTs has the following benefits: it ensures precision, standardisation in drawings, and measuring accuracy; it saves time, and erasing mistakes is a simple "undo" function; complex drawings can be done with ease in 2D CAD and it provides a method of fitting various components; CAD software allows virtual simulations of drawings and designs, and 3D AutoCAD allows different components to be assembled to present a final product. Also, 3D objects or models convey clarity in understanding complicated engineering drawings and design concepts in a precise and accurate way. Because of the ease of visualization, 3D models can be obtained by drawing them in 3D CAD, printing the model with a 3D printer, and seeing it after a model has been scanned with a 3D scanner or animated in 3D animation (Sharma & Dumpala, 2015).

The use of ICT in the classroom is significant for meaningful interaction between learners and teachers to carry on in an information age (Adelabu, Alex, Ngwabe, Tatira, & Boateng, 2022). Furthermore, due to the knowledge explosion, educational institutions, including schools, can no longer function as places that transfer knowledge from teacher to learner or rely solely on textbooks as the primary source of information; they must be innovative (Patricia, Isaac, & Manto, 2023). ICT provides teachers and learners with the opportunity to use, manipulate, store, and retrieve information. Teachers and learners can also use ICT to plan and prepare lessons, create materials, and share resources, knowledge, and advice. As a flexible tool, ICT can assist learners in solving complex issues to enhance their cognitive abilities, while also engaging them in instructional activities to boost learning (Kumar, 2020).

ICT makes education more effective because the conventional teacher-centred method is altered by ICT, which forces educators to be more inventive when modifying and adjusting their materials. With the infusion of ICT in the educational system, the classroom is no longer teacher-centered, but rather learner-centred, which many teachers find challenging (Clark & Scales, 2009). The advantages of moving toward a learner-centred approach to higher education are becoming increasingly apparent. Using the teacher and knowledge transfer model, the goal is to shift from a teacher-centered paradigm to the new learner-centred paradigm through skill development and learning that can be applied to different situations, places, and eras. ICT in EGD assists teachers in formulating their lessons interesting and offered in learner-centred environment. It also promotes independent and active learning, self-responsibility for learning, and

inspires teachers and learners to continue learning even after class. Nowadays, learners utilise computers more regularly and purposefully (Kumar, 2020). Khan (2020) argued that integrating ICT into teaching and learning has the potential to raise learners' accomplishment, particularly in communities with low socioeconomic status where student achievement is more likely to fall short of expectations. The growing use of ICT resources in classrooms, such as educational films, is empowering learners to take charge of their education by enhancing their comprehension and conceptualization of concepts (Agyei, 2021). When any of the ICT tools and techniques are used, learners become more involved and more interested in learning at their speed; they can learn anytime and anywhere (Agyei, 2021). The ICT Tools and Techniques give teachers and learners plenty of chances to interact with a variety of tools and technology, learn at home, and practice being safe and healthy.

Given the large expansion and extensive globalization of education, there is a great need for ICT in education. Recently, we have been introduced to digital applications that read texts from books, scholarly articles, thereby allowing learners to multitask while learning (Kumar, 2020). ICT also provides a platform for independent learning, allowing learners to practice and improve their skills outside the classroom. Moreover, social media platforms have also emerged strongly as a convenience strategy to improve learners' educational experiences. The greatest advantage was that learners were able to interact with others, which subsequently created an everlasting learning society as portrayed. Teachers and learners can collaborate and communicate more effectively while using AutoCAD (Hanimolu, 2018). Mhlanga, Denhere, and Moloi (2022) posit that since the abrupt change to online learning for most institutions in 2020, teaching with technology is fast becoming the classroom practice that every teacher wishes to have. The final product is a clear and precise drawing. To sum up, AutoCAD has several important advantages in EGD. According to Sally PW Wu, and Martina A Rau (2019), it improves learners' capacity for visualization, enabling them to translate abstract ideas into aesthetically appealing representations. AutoCAD encourages accuracy and efficiency in EGD. Additionally, AutoCAD makes it easier for learners to collaborate and communicate effectively, which promotes cooperation and improves their capacity to express creative intent. By utilizing these advantages, AutoCAD makes a substantial educational and career-preparation contribution to engineering learners.

FACTORS THAT HINDER THE USE OF AUTOCAD IN THE EGD CLASSROOM

Since many institutions view technology integration as a strategy to get learners ready for global engagement and increase their responsibility and engagement, technology has a big impact on how well learners learn (Hanimolu, 2018; Wieking, 2016). Even though ICT is now more widely available in some schools, there is still limited real integration. To improve learner engagement, comprehension, and readiness for a digitally driven job, it is crucial to comprehend teachers' perspectives to bridge the gap between old approaches and contemporary expectations (Maeko et al., 2025). However, since integrating technology is difficult, it's important to pinpoint the barriers that prevent AutoCAD from being used in EGD classes. According to Yeh et al. (2011), problems that prevent the integration of CAD in EGD classrooms include the absence of engagement between various stakeholders to develop goals and tactics for integrating technology in both classroom and school contexts. The teachers ought to be present when decisions about curricular improvement are being considered. Supporting this, Singhavi and

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Basargekar (2019) concurred that they must be included in the planning process up to the implementation stage since they may share more learner-related experiences through their instruction. Hunduma and Seyoum (2023) postulate that barriers to ICT integration can be classified as extrinsic or intrinsic. By association, extrinsic barriers are those involving a lack of resources, such as equipment and technical assistance. Intrinsic barriers are associated with having people and administrators to ensure the smooth running of ICTs.

According to a study by Habibu, Mamun, and Clement (2012), most developing countries face similar difficulties in integrating ICT into classrooms. These difficulties include unstable economies, underdeveloped ICT infrastructure, high connectivity costs, unreliable electricity supply, general lack of resources, etc. Like other variables, poor use of ICT in the classroom for teaching and learning must be taken into consideration in the framework of education. Other barriers included a lack of genuine software, inadequate computers in the classroom, slow internet, a lack of ICT use motivation on the part of the teacher and learners, a lack of proper training skills, a lack of the most recent technology, a lack of knowledgeable technical staff, and poor ICT infrastructure (Arrieta, 2020) and Habibi, et al, (2020). Unstable Internet connectivity is a persistent issue that goes beyond South Africa's borders.

Dube, Nhamo, and Magonde (2018) also report that ICT integration is feasible in physical education, even though there are still challenges due to a lack of physical education-specific ICT training for teachers, and that there is no specific ICT software for physical education in such schools. Because of gradual improvements in the ICT field, challenges will forever be experienced in having software that deals with a specific discipline. However, Ngcapu, Simelane-Mnisi, & Mji (2022) report that while other disciplines may experience more ICT improvements than others, there are great benefits associated with ICT inclusion.

Many teachers encounter the problem of perception when using ICT in the teaching and learning process in the classroom (Kurniawan, 2014). Ward, Gristein, & Keim (2015) describe perception as the process of recognizing, organizing, and interpreting sensory information. Teachers are reluctant to make modifications to their teaching methods and include additional learning linked with computers because they lack the necessary expertise and abilities. ICT uptake and acceptability by teachers is thus a concern. As a result, educators who do not utilise computers in the classroom often cite "lack of skills" as a barrier to ICT usage. It was also discovered that using ICT in technical and higher education institutions was seriously hampered by teachers' lack of knowledge and teaching abilities (Habibu, Mamun, & Clement, 2012).

According to Makgato (2012), teachers do not use ICT resources because they are technophobic; it is because the traditional teacher-centered approach they employ provides them with a sense of power in front of their learners. Nonetheless, Boice et al. (2021) contend that teachers should not be hesitant to use educational technologies as they offer innovative twenty-first-century teaching and learning experiences. According to Rapanta et al. (2020), teachers maintain that they can still achieve successful learning outcomes without the use of ICT devices by utilizing traditional methods such as oral instruction and drawing. Thus, it is important to keep up with the momentum of using ICT resources even when teachers are at ease with their traditional teaching approaches.

ICT integration is progressing more slowly than anticipated in some school environments, despite the ambition to see technology become a "game-changer" in the South African educational system. The DBE launched Operation Phakisa (phakisa means hurry up in Sesotho), which it refers to as a mechanism for accelerating and monitoring the execution of its ICT strategy in schools across the country (Kwet, 2017). Operation Phakisa is a mindset that guarantees quick identification of current problems so that appropriate remedies may be provided to improve the situation (Kwet, 2017). Nevertheless, Chisango & Lesame (2017) note that ICT has failed to significantly improve several underfunded schools across the entire country. For instance, Pholotho and Mtsweni (2016) noted that inadequate service delivery was one of the reasons why some schools in the South African province of Limpopo were still not receiving significant benefits from the government's ICT-integration plan. Lack of adequate resources in schools, such as textbooks, laptops, desktops, software, and unreliable electrical power, dampened the spirit of teachers to integrate AutoCAD. Lack of mastery of AutoCAD teaching techniques and lack of educators' training to bridge the gap have become obstacles that inhibit the integration of AutoCAD in schools. It is difficult for teachers to integrate AutoCAD because they are novices in that area. Despite the fact that ICT has emerged as a key component of contemporary education (Moses and Paul, 2023), its integration remains unclear because of the intricacy of the subject.

THEORETICAL FRAMEWORK

The adoption and application of ICT in EGD teaching and learning is the main focus of this study. Its primary objective is to explore the benefits of technology instruction in EGD classrooms. To support this aim, the Technology Acceptance Model (TAM) by Davis (1985), was adopted as a theoretical foundation. One of the most popular study models for examining the use of technology in education is TAM, which is also used to predict the extent to which a particular user would embrace and use a certain ICT system (Surendran, 2012). TAM has six interrelated constructs made up of internal and external variables. However, Davies (1985) suggested that the motivation can be explained by perceived ease of use (PEOU), perceived usefulness, and attitude towards using the system. Numerous external factors can impact an individual's perceived usefulness and usability. According to Surendran (2012), the main factors that people most frequently exhibit are social, cultural, and political aspects. Perceived usefulness and perceived ease of use are established traits that can be used to predict a person's behavior, according to the TAM (Edmunds, Thorpe & Conole, 2012). According to Surendran (2012), these two crucial features are the most significant ones that affect how the system is utilized. Perceived usefulness is the extent to which an individual thinks that a particular information or technology system can enhance their capacity to accomplish their tasks (Davis, 1989).

Teo, Lee, and Chai (2008) note that one aspect of perceived utility is the reduction in time needed to complete a given task when using an ICT system. Therefore, if teachers think the program is time-consuming, they won't find it to be as useful (Teo, Lee & Chai, 2008). According to Davis (1989), perceived ease of use refers to how little effort a person perceives any information or technological system to require. The competence of EGD teachers concerning using AutoCAD seems to be a predominant factor in whether they perceive AutoCAD to be easy or not. Davis (1989) continues by saying that while the person may find the computer simple to use, they might find the application itself challenging and avoid using it as a result. According to Surendran (2012),

the attitude toward use is a person's assessment of whether using a specific technology system is desirable. The purpose of this study focuses particularly on the benefits of using AutoCAD in EGD classrooms. Hence, the TAM was used to understand the perceived usefulness and perceived ease of use for teachers who are using AutoCAD.

METHODOLOGY

There are three approaches that researchers must choose from when carrying out a study namely, the qualitative approach, the quantitative approach, and the mixed methods approach. Consequently, this study deemed it fit to employ a qualitative research approach, as guided by the research purpose, which was to explore the benefits of AutoCAD in EGD classrooms. Throughout the study, the researchers engaged in direct communication with the participants, recognizing an interaction between the two parties (Maree, 2014:55). Thus, this study collected data through semi-structured interviews and classroom observations as a data collection instrument. The data was kept confidential and private. In addition, pseudonyms were used to shield the identities of the participating EGD teachers. Seven (7) EGD teachers from Bohlabela district, Mpumalanga province of South Africa was purposefully selected. All ethical considerations were followed where information letters were sent to schools, after permission to conduct the study was sought from the local district education. Consent forms were issued out to participants, and issues of voluntary withdrawal on or before the commencement of the study were mentioned. We also made it clear that there would not be any remunerations for one to participate in the study and that the study does not pose any harm to the teachers. It is significant to mention that this study used the sample of EGD teachers that were available because EGD is a rare subject that is not offered in all schools (Mlambo 2023). This also clarifies the exclusion of other schools from the study. To add to that, when going through data, we realized that from participant 5, there was no new information that was coming forth because we had reached saturation point hence we stopped at participant seven.

DATA ANALYSIS

Data analysis is the process of transforming collected data into concepts and facts that can be understood either qualitatively or quantitatively, according to Alem (2020). Thematic data analysis was used in this study for both instruments to scientifically identify, gather, and explain relevant patterns (themes) within the collected data (Braun and Clarke, 2012). Because semi-structured interviews allowed for the collection of direct information from the teachers, they were used. Researchers followed the six phases of thematic data analysis, which include familiarizing yourself with the data, generating initial codes, developing themes, reviewing potential themes, defining and naming themes, and producing the report during data analysis (Braun & Clarke, 2012).

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FINDINGS AND DISCUSSION

The study was about the benefits of AutoCAD in EGD classrooms. Analyzing and identifying the participants' demographic data—specifically, the teachers' age, highest qualification, and teaching experience—was deemed crucial by the researchers. The researchers considered gender with the idea of attaining balanced data. While 57.1% of the participants were male, 42.9% of the participants were female. The table below represents the demographic information of the participants:

Table 1 . *Participants' demographic information*

Qualification type	Frequency	Percentage (%)	Gender	Frequency
Honours	2	28.6%	Males	4
Bachelor of Education	5	71.4%	Females	3

The gender balancing gave the study an open understanding of the field as non-gender-based and open to everyone.

DATA PRESENTATION AND DISCUSSION

This section presents integrated data findings of both the teachers' interviews and classroom observations. The participant's answers to the given question are listed below.

When teachers were asked about the kind of technology that they use, only one theme emerged. Theme: Varied Levels of Technology Adoption.

THEME 1: Varied Levels of Technology Adoption.

The responses above clearly show that the adoption of ICT in education has compelled even EGD teachers to integrate ICT in the teaching and learning of EGD. Teacher 1, from school 1, said: *"I use AutoCAD, PowerPoint, Sketch Up, and I also make use of the tablet that the learners received from the department."* To add to that, Teacher 4 said: *"I use videos from the JP workbook, and sometimes I use videos from YouTube. I used to use AutoCAD, but unfortunately, the laptops were stolen. However, I am also using WhatsApp to send them some videos so that even at home, they can use those videos since the department is giving them tablets."* Teachers are using overhead projectors, WhatsApp, videos, and PowerPoint, which means that changes in infusing ICT into their teaching and learning are great. However, not all educators recognize the value of incorporating technology into EGD classes. The above utterances were later observed in Teacher 1 where classroom technology assisted in the teaching of EGD. Teacher 1 made use of AutoCAD to teach and that brought a lot of learner attention in class. This was also observed in Teacher 4 who made use of videos from the prescribed workbook that we often use in the district and learning was much better. WhatsApp was also used where learners were made to refer to what the teacher and the learners discussed in the evening, which showed that using technology, ensures that

learning happens anytime, anywhere and often. The observation added to an assertion made by Surendran (2012), that when one dwells much in adopting technology use in class, the more they embrace it.

Mlambo (2023) argues that the use of ICT in EGD lessons helps learners understand certain concepts better, leading to higher performance in sections that students find difficult to understand. These technologies not only help learners, but also teachers as well deliver content in an easy manner that is beneficial to students. This gives learners better and unlimited learning options, including engaging learning environments. South Africa has continually mobilised resources and efforts to achieve a paperless classroom. The literature in Chapter 2 indicated that ICT may help to enhance learners' capacity to learn across subjects and fields. The National Development Plan 2030 for South Africa, therefore, includes the country's ICT mission (Mjwara, 2017). For instance, the Gauteng Provincial Education Department enthusiastically supported and embraced the ICT integration effort to provide ICT tools to all learners to make studying easier and more fun (Odendaal, 2017). Also, the Mpumalanga Provincial Education Department has provided all Grade 12 learners with tablets and teachers with laptops to improve teaching and learning. This indicates that teachers and learners are exposed to ICT.

The first question was about the type of technology teachers use to teach EGD? Below is how they responded:

Teacher 1 from school 1 said: *"I use a laptop that has an AutoCAD software, PowerPoint, SketchUp, and I also make use of the tablet that the learners received from the department."*
Teacher 4 said: *"I use videos from the JP workbook (which are prescribed EGD textbooks that contain drawing tasks), and sometimes I use videos from YouTube. I used to use AutoCAD, but unfortunately, the laptops were stolen. However, I am also using WhatsApp to send them some videos so that even at home, they can use those videos since the department is giving them tablets."*

Teacher 3 replied and said: *"I use AutoCAD 2021 version, and sometimes I use the videos from the workbook, that's the only kind of technology I am using."*

Teacher 5 from School 5 said the following: *"The technology I am using in my class is only the videos from the JP workbook because I only have the project, and the department is sending us the link for the JP workbook."*

Teacher 6 answered as follows: *"None, I just use the traditional way of teaching because of the resources."*

Teacher 7 said the following: *"During my presentation, I use AutoCAD, PowerPoint, the videos from the JP workbook, and SketchUp."*

From the responses above, one theme emerged. Theme: The use of AutoCAD is minimal in EGD classrooms.

THEME 2: The use of AutoCAD is minimal in EGD classrooms.

The information above shows that some teachers are not using AutoCAD in EGD classrooms, and some are using it. Even those who are using it, are not consistent as they don't frequently use it. Teacher 4, from school 4, said: "*I am no longer using AutoCAD in my classroom. The department delivered the laptops to our school, but unfortunately, they were stolen. I use my laptop to demonstrate the 2D and 3D drawings*." To add on that, Teacher 3 replied and said: "*AutoCAD, I am not constantly using it reasons behind it do not contribute to the end-of-year mark, even in PAT (Practical Task Assessment), it is optional to use it. For that reason, I feel like it's time-consuming. There is no time allocated for it in the ATP (Annual Teaching Plan), and it requires a lot of time*." During the classroom observation, Teacher 3 used videos that come with the prescribed EGD workbook which we call JP Workbooks. Much as the videos are more of technological in nature, they are not the same as when one uses AutoCAD. However, the fact that there is an endeavour of technology use, demonstrates that teachers are aware of the need to explore their teaching by using technology. Teacher 3 proved that perceived usefulness and perceived ease of use are the established traits that can be used to predict a person's behavior, according to the TAM (Edmunds, Thorpe & Conole, 2012), which in this case is what the teacher believed that it works in the classroom. Perceived usefulness is the extent to which an individual think that a particular information or technology system can enhance their capacity to accomplish their tasks (Davis, 1989). However, in a situation where infrastructure constrains teaching, that notion is not possible.

This shows that some institutions view technology integration as a strategy to get learners ready for global engagement and increase their responsibility and engagement. Technology has a big impact on how well learners learn (Hanimolu, 2018; Wieking, 2016). However, since integrating technology is difficult, it's important to pinpoint the barriers that prevent AutoCAD from being used in EGD classes. According to Yeh et al., (2011), problems that prevent the integration of AutoCAD in EGD classrooms include the absence of engagement between various stakeholders to develop goals and tactics for integrating technology in both classroom and school contexts. However, this shows that not all teachers have the luxury of using AutoCAD, but they are in the same District; some have the resources, some don't have them. The teachers ought to be present when decisions about curricular improvement are being considered. Supporting this, Singhavi and Basargekar (2019) concurred that they must be included in the planning process up to implementation since they may share more student-related experiences through their instruction. Hunduma and Seyoum (2023) postulate that barriers to ICT integration can be classified as extrinsic or intrinsic. By association, extrinsic barriers are those involving a lack of resources, such as equipment and technical assistance. Intrinsic barriers are associated with having people and administrators to ensure the smooth running of ICTs. This was further stated by Alharbi (2021), who disclosed that a lack of ICT resources is inadequate in schools, which makes it hard to infuse ICT effectively.

The third question posed was about how often do teachers use AutoCAD and, if not, why teachers are not using it.

Teacher 1 from school 1 answered as follows: "*I use AutoCAD almost every day in school and for commercial use. The challenge is that we receive the license very late, as we depend on the*

department to get the license. The school cannot afford the license because it is expensive, and it must be renewed every year."

Teacher 4 said: *"I am no longer using AutoCAD in my classroom. The department delivered the laptops to our school unfortunately, they were stolen. I use my laptop to demonstrate the 2D and 3D drawings."*

Teacher 3 replied and said: *"AutoCAD, I am not constantly using it reasons behind it do not contribute to the end-of-year mark, even in PAT (Practical Task Assessment), it is optional to use it. For that reason, I feel like it's time-consuming. There is no time allocated for it in the ATP (Annual Teaching Plan), and it requires a lot of time."*

Teacher 5 from school 5 answered as follows: *"I don't use AutoCAD; our school doesn't have the resources required to integrate it. I use the traditional way of teaching. I do attend training for it if the department organises it, just to equip myself, hoping that one day we will have the resources. Our school only has the overhead projector, which we use for the videos."*

Teacher 6 replied as follows: *"I am not using it in my classroom, but I did it in university. I am not using it because in our school we don't have the equipment, like computers. When I arrived here at school, they were not using it, and it was not easy to implement it. I am just using the traditional way."*

Teacher 2 from school 2 responded like this: *"AutoCAD is used in this school, but not frequently because time is not enough time. EGD has only 4 hours a week in the Annual Teaching Plan (ATP), and it is a practical subject that requires much time. AutoCAD also requires a lot of time because some of the learners are computer illiterate."* From the responses below, one theme emerged. Theme: AutoCAD improves the way teachers used to integrate EGD.

THEME 3: AutoCAD is used based on the availability of resources

It was evident that not all teachers integrate AutoCAD in EGD, because of lack of resources. Chisango & Lesame (2017) note that ICT has failed to significantly improve several underfunded schools across the entire country. For instance, Pholotho and Mtsweni (2016) noted that inadequate service delivery was one of the reasons why some schools in the South African province of Limpopo were still not receiving significant benefits from the government's ICT-integration plan. This is the same case in schools where this study was conducted because when teacher 4 said that the laptops that were delivered in their school were stolen, it boils down to poor service delivery where school still reel from security issues. During classroom observation, teacher 4 made use of a drawing sheet and pencil which we call manual teaching. This, much as is in line with how the exams are conducted, does not prepare learners for tertiary education where technology is the medium of instruction. The outbreak of COVID-19 made tertiary institutions adopt blended learning with may still enjoying full online facilitations. During COVID-19, the entire education sector saw a pedagogical shift in adopting online teaching (Siddiquei & Kathpal, 2021). During the outbreak of COVID-19, instructional practices were through online methods. Various new methods of online instruction were introduced to support the online learning environment. Some institutions fully made use of their respective LMS which range from Ulwazi, Moodle, Blackboard, Brightspace, etc. and this facilitated online education even though many lecturers

had to learn the system while learning is continuing. However, the continuing lack of resources which hamper the use of AutoCAD, is making the already visible progress in tertiary education levels, a serious concern because schools are seemingly being left behind

Attested by Carey (2017), Constantine (2017), Ottway, Serdar & Harm de Vries (2015), that teachers must not only require learners to have specific knowledge and drawing skills to produce the required drawings, but also need spatial visualisation skills to create, interpret and understand different drawings, which improve critical thinking skills, modelling and the ability to solve problems, which is a skill that is easily horned by digital learning like the integration of AutoCAD. Learners also need to develop the ability to visualise how parts fit together, how to draw a component that is sectioned, and how to convert a drawing from a 2D to a 3D view. In the responses, they also outline that the use of AutoCAD helps them to be able to set EGD question papers. This is a challenge for most of the EGD teachers. Teachers rely on the papers they are provided by the department; they cannot set their own question papers because they cannot draw using AutoCAD. Even the researcher depends on the papers from the department, so AutoCAD improves critical thinking skills. Teachers are transforming from their traditional methods of teaching to digital ones. The extraordinary COVID-19 outbreak has made it more important than ever to integrate ICT into education. In addition, several modifications related to COVID-19 were implemented in the educational sector, including the substitution of online learning for traditional classroom settings and the use of ICT as a supplementary tool. The consequences of COVID-19 on education were further explained by Khoza (2021), who said that to save education from the pandemic, COVID-19 forced the Member of the Executive Council (MEC) Panyaza Lesufi of education to introduce the paperless classroom program. Teachers now even enjoy their lessons because they are using PowerPoint, and it also saves time in teaching and learning. The ICT tools and techniques are fascinating, easy to use, and have a wide range of applications in online education. Teachers and learners can search for information. Learners in our days search for information on their own; they do not depend on the teacher.

Another question was asked about the educator's opinion on integrating AutoCAD into EGD. Below is how they responded:

Teacher 4 had the following to say: "*My opinion about AutoCAD, I will say it is a good program, but I think EGD South Africa is not ready to implement it because of the way it is assessed. It does not motivate us as teachers to integrate it. If the curriculum for EGD can be revised, it can accelerate the use of ICT in EGD. Learners get excited when they draw using AutoCAD, unfortunately, during their exam, they draw using instruments, and not a computer, so it becomes useless to use AutoCAD in EGD, hence I said South Africa is not ready to implement AutoCAD in EGD."*

Teacher 3 said: "*AutoCAD in EGD makes the work easier for both the teacher and the learner because it does not require spatial visualisation, and you can see the drawing in 2D and 3D. It is more practical."*

Teacher 5 from school 5 answered as follows: "*AutoCAD in EGD makes the learners become technology inclined and helps them to have zeal in pursuing engineering studies. It is fast, u can cover a lot of work in a short period."*

Teacher 6 had to say: *"In my opinion, AutoCAD in EGD is a program that makes the learners enjoy the subject, even though in our school we don't have the resources to integrate it. If AutoCAD can be implemented in all schools, schools will produce learners who are skilled in drawing using computers, and they can make a living out of it. E.g., drawing plans."*

Teacher 7 said the following: *"AutoCAD is useful to us as teachers because we can set question papers for EGD, because if you can't use AutoCAD, you can't set a question paper. Most educators cannot set EGD question papers; they just cut and paste because they can't use AutoCAD. The department must conduct more workshops so that we become experts in setting our question papers, not cutting and pasting. AutoCAD also improves our computer skills."*

Theme: AutoCAD enhances learning

The above theme and teacher responses proved that teachers are aware of what digital learning can do. However, this is hampered by the lack of digital tools in their spaces. This was observed in teachers 5, 6 and 7 classes where they used manual teaching methods where learners drew using the normal drawing sheet and a pencil. Much as learning was taking place in the classrooms of those teachers, the available 'manual' equipment was not even of good quality. In teacher 5, not all learners had drawing desks, and teacher 6 and 7 had their learners sharing workbooks. Normally, workbooks have drawing sheets that are readily available for learners to work on, but with the scarcity of workbooks, learners had to copy on a blank A3 drawing sheet to draw. According to a study by Habibu, Mamun, and Clement (2012), most developing countries face difficulties in integrating ICT into classrooms. These difficulties include unstable economies, underdeveloped ICT infrastructure, high connectivity costs, unreliable electricity supply, general lack of resources, etc., which make learning and teaching difficult. Hunduma and Seyoum (2023) postulate that barriers to ICT integration can be classified as extrinsic or intrinsic, however, the extrinsic ones are direr because they may be political, social and or economical, which would end up having incompetent output. However, Davies (1985) suggested that the motivation can be explained by perceived ease of use (PEOU), perceived usefulness, and attitude towards using the system.

CONCLUSION

In summary, AutoCAD offers several key benefits in EGD. It enhances learners' visualization abilities, allowing them to transform abstract concepts into visually engaging representations. Through hands-on experience with AutoCAD, learners develop practical skills that are highly sought after in engineering industries. The software promotes efficiency and accuracy in design work, enabling learners to create precise and consistent drawings. Moreover, AutoCAD facilitates collaboration and effective communication, fostering teamwork and enhancing learners' ability to convey design intent. By leveraging these benefits, AutoCAD contributes significantly to the education and preparation of EGD learners for successful careers in the engineering field. However, if the challenges in schools, which the teachers have alluded to, which range from unprotected property that result into theft persist, a digital nation that we strive for as a country for a competitive citizenship will not be realized.

The study limitations are that the sample size was way too small and perhaps had it been more than 10, we would have got better conclusion. Future research should look into similar study but in many districts of the same profile and with an increased sample of the same EGD subject.

CONFLICT OF INTEREST

Author confirms that there is no conflict of interest present in this study.

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