Journal for the Education of Gifted Young Scientists, 9(5), Special Issue, 39-338,Dec 2021
e-ISSN: 2149- 360X
jegys.org

youngwisepub.com
© 2021

Research Article

Exploring e-tutors' technological knowledge of the design process to facilitate the design step to advance giftedness of students in an ODeL education

Mpipo Zipporah Sedio[1]

Department of Science and Technology Education (DeSTE) at UNISA, South Africa

Article Info

Received: 09 October 2021
Revised: 17 November 2021
Accepted: 11 December 2021
Available online: 30 Dec 2021

Keywords:
Design process
Design step
e-tutoring
Open Distance e-Learning
Technological Knowledge

2149-360X/ © 2021 JEGYS
Published by Young Wise Pub. Ltd.

Abstract

In an ODeL context, the design step of the design process is regarded a vital component that should be taught in the Technology curriculum. Teaching the design step in an ODeL setting places specific expectations on qualified e-tutors who can prepare students for the workplace. The central question of this research is "How does e-tutors' technical knowledge influence effective teaching and learning of the design step?" The study focused on 560 postgraduate students enrolled in a semester module in 2020. An online survey was used to investigate the technological expertise of e-tutors in order to facilitate the design process step for advancing giftedness in students in an ODeL setting. The information gathered from five e-tutor sites was analyzed. The findings reveal that e-tutors in ODeL settings lack the ability to choose technologies that will help students understand the design step content. Suggestions: based on the present model, an alternate technique for e-tutor appointments is proposed.

To cite this article:

Sedio, M.Z. (2021). Exploring e-tutors' technological knowledge of the design process to facilitate the design step to advance giftedness of students in an ODeL education. *Journal for the Education of Gifted Young Scientists*, *9*(5), Special Education, 39-48. DOI: http://dx.doi.org/10.17478/jegys.1021319

Introduction

The introduction of the Covid-19 epidemic provided chances for several higher education institutions that already had an Open and Distance eLearning (ODeL) setting to expand their concept of e-tutoring, how the design step of the design process is taught and online teaching with technology. Pownall et al. (2021) advised that uses of various technologies advance more integration with a larger population of students and also the generation of rich online content. The design step of the design process is an area of attention for online content that stands to profit from integrating technologies. However, it is yet unclear how useful the technological expertise provided by e-tutors is in facilitating the learning of design step through the usage of such technologies. For a long time, technological knowledge took centre stage and dominated important scholarly debates, allowing for more in-depth understanding of the concept. The widely held knowledge of the concept is a thought of navigating understanding outside of what has previously been understood about the concept in this work. The navigational understanding allowed for the creation of information regarding how the e-tutors' choice of technology aided the design step. As a result, it is yet unknown how much the acquisition of such technology expertise effects the e-tutors' effective facilitation of the design step.

The concept of e-tutors, who are tasked with facilitation at a distance, is central to the entire design step. According to Maré and Mutezo (2021), several ODeL institutions, including UNISA, became forerunners in incorporating the

[1] Lecturer in the Department of Science and Technology Education (DeSTE) at UNISA, South Africa. E–mail: sediom@unisa.ac.za ORCID: 0000-0001-6752

e-tutor model as part of their student assistance programs, with the goal of increasing student success rates. At the same time, the value of an e-tutor model is that it allows students to better understand the content of module programs by encouraging and supporting online cooperation for technological tools Ravioloa et al. (2021). These technological tools are intended to be used by e-tutors during facilitation to demonstrate technology competence to the students.

It's because these tools allow e-tutors to interact with students at a distance during student support. As a result, using technology tools like Franchuk and Prydacha to engage students in online lectures improves their effectiveness (2020). The ability of e-tutors to introduce technology tools developmentally is at the heart of such tools, according to Baker and Kassimer (2021), and thus their efficacy is better positioned for the facilitation of the design step.

The value of e-tutors in assisting with the design process cannot be overstated. To do so, it's crucial to understand the policy imperatives surrounding the curriculum subject in schools, as well as the policy imperatives surrounding e-tutoring. Teachers make up the majority of the institution's customers, therefore knowing the policy imperatives in schools is crucial. Teachers who are already in practice and have enrolled in higher learning institutions to increase their theoretical understanding of the subject that they already teach have two features. Another group of new teachers is still in the process of being trained. As a result, an e-tutor must be familiar with the two types of teachers they assist. At its core, the subject policy must make e-tutors a priority in order to assist the two groups of teachers. The subject is called as Technology, and it is included in the formal curriculum of South African schools for grades R through 9. It is defined as the use of knowledge, skills, attitudes, and resources to meet people's needs and desires by devising practical solutions to issues while considering social and environmental aspects Curriculum Assessment and Policy Statement (CAPS) (2011).

As a result, the (CAPS) (2011) is very precise about its purpose, goal, intention, and the significance of the design process. According to the CAPS (2011) document, the need for developing engineers, technicians, artisans, and technologically literate pupils motivated the introduction of the topic in schools. Its main goal is to help people become more technologically literate by teaching them how to design. Its goal is to familiarize students to the fundamentals of the workplace. Also, it is critical to create proficiency in civil, architectural, electrical, mechanical, and structural engineering vocations. The purpose, particular goals, and intention of the subject, as well as the importance of the subject to the design process, are all connected to what this paper intends to achieve as giftedness in students during the design step of the design process.

Furthermore, because giftedness is at the heart of this study, there are policy imperatives worth noting in relation to e-tutoring, which is viewed by e-tutors as a support mechanism for the students they tutor. Student support is considered essential for distant students in the setting in which this study was written. This came after the University of South Africa (UNISA) launched an e-tutor concept in 2013 to help students. The execution of this strategy is carried out by appointing adequately trained e-tutors to teach the modules in the university's many colleges, departments, and units. An Honours degree in the field of expertise is the policy prerequisite for a suitably trained e-tutor.

For the sake of this article, an ideal e-tutor is someone with a Technology Honours degree. Another policy requirement is that one e-tutor be provided to per hundred students in a module to provide support. This is significant because it implies that each e-tutor is chosen on their own merits and is expected to function as an individual, even if there are more than five or even more tutors assigned to the students. In this study, the individual distinctive observable evidence from the constructs that were generated for the paper will be used to assess how well an e-tutor implements the design stage curriculum. The presentation of the findings will be deduced from these based on the unique variants from individual e-tutor sites, and a judgment about the objective will be drawn.

In addition to the e-tutor approach, UNISA launched a 2013 Institutional Operational Plan in which all NQF Level 5 (1st year) modules across the University were intended to have e-tutors assigned to the students. This paper is based on one of the courses that is being considered for inclusion in the e-tutor paradigm. The official curriculum for the design process of Technology will be taught by e-tutors in the course.

There is universal agreement that professional engineers and what teachers, including e-tutors, emphasis on the facilitation of the design process, there are variations. Lin et al. (2021). E-tutors must first have confidence in their ability to communicate the design phase in a self-sufficient manner (Smith et al., 2021). Engineers, on the other hand, use specific inventive talents for the design process to uncover new opportunities more rapidly and precisely (Han et al., 2021). The distinctions in facilitation are disputed because e-tutors are only permitted to participate in the design phase. This exposition is problematic because drawings are essential in engineering and architectural education, yet the e-tutors Sung et al. (2019) are expected to teach them differently. Also, keep in mind that the usage of diagrams in the design process is considered a tough and diverse vital skill for students to develop their ability to transmit ideas and increase and improve their communication skills. Hello, Alok (2021). In light of this, a potential issue may arise as to how the e-tutors make drawings of the design step relevant in practice, given that they lack professional drawing skills. The design step of the technological process is taught in an ODeL environment by e-tutors without the usage of drawings in this article. As a result of this mandate, there is a growing expectation about which drawings the e-tutors will use to achieve the aims of the modules they teach online. Both 2D and 3D dimensional diagrams are used to predict the success of the final items at the design stage.

2D diagrams are close representations that provide more information about themselves than drawings Ocal and Halmatov (2021). They are the foundation upon which the design step is taught. For the reasons stated, more emphasis is placed on teaching individual traits rather than generic Komatsu and Jones attributes (2020). According to Kiernan et al. (2021) one advantage of such diagrams is that it is a gateway to students' deeper learning because it provides significant insights into how their sketching imaginations grow. As a result, 2-diagram drawing is regarded as a key common communication medium between students and their teachers, despite the fact that it is dwindling due to design software (Mohammed, 2021). However, be aware that the way 2D diagrams are constructed might pose problems for pupils, as components that are not vital for a diagram receive more emphasis than those that are important (Haj-Yahya, 2021). In this study, it is assumed that e-tutors possess some fundamental knowledge from which they can benefit from the drawing of 2D diagrams using simple technologies for students.

3D diagrams depict the actual living world space and are created using models that teach pupils about spatial awareness (Ocal et al., 2021). Furthermore, 3D diagrams have been examined for decades, with their distinguishing characteristics remaining those that demand exact line drawings from many views at the same time, as well as those that fail to become simple to draw (Zhang et al., 2021). This view by Zhang et al. (2021) dismisses the relative importance in this article of how e-tutors are envisioned to contribute to a better knowledge of how 3d diagrams are taught using technological means. Nonetheless, the theory behind 3D diagrams is that they generate certain abilities that are required of students during the design stage of the design process, according to Pittalis and Christou (2010). Such abilities are required since 3D free hand drawings can be sloppy, with simplifications and distortions, resulting in the possibility of many explanations for the same diagram (Xueting et al., 2020).

It is unknown how well-equipped the e-tutors are in terms of developing specific abilities for 3D diagrams.

Theoretical Framework

The paper was based on a constructivist learning theory, which looks at how students learn from the practices that their e-tutors use to help them learn. The act of e-tutors facilitating learning means that students generate knowledge from activities that are specific to their learning. The expectation is that students will become active participants in their learning as a result of these activities.

Literature Review

ODeL institutions decided to teach the design process curriculum as a way for students to gain hands-on experience with skills that expose them to design knowledge. Distance education necessitates the use of technology by the students. Hietajarvi et al. (2020) found that certain students who have extensive encounters with technology outside of school feel alienated and disengaged at institutions in a study done on the use of such devices. According to the findings of (Tyrus & Harasymenko, 2021; Zhaldak et al. 2021), the instructional function of tools was not devoted to the cognitive processes of students at a distance, resulting in an unorganized transfer of technological skills. Vegliane and Sannicandro (2020) found that the pedagogical technological function of e-tutors is under examination since it did not bring the efficient use of technology for the design stage of the design process.

In contrast to previous findings, Franchuk and Prydacha's (2020) findings revealed that some resources (You Tube movies) were selected to engage students and serve as motivation and stimulation for their educational efforts. Franchuk & Prydacha (2020) agreed with Komatsu and Jones (2020), who found that when such tools are utilized for online learning, they have a good influence on learners who had low spatial abilities at the start. The ideas presented in this section are critical to achieving the paper's goal of achieving gifted kids during the design phase.

Hand sketching has nearly always been used to depict design ideas, however with the rising usage of digital drawing tools, 2d diagrams may be considered to benefit from such an invention (Taraszkiewicz, 2021). The same momentum as previously said sets the tone for the goal, which already attracted attention to determining the e-ability tutor's to exploit digital materials for the design step's 2D diagrams. In a study by Rohendi et al. (2021), it was confirmed that pupils found it challenging to go from 3D to 2D visuals. Simultaneously, Serrano et al. (2021) discovered that some engineers only sketched on occasion and only for 2D drawings. Anamova (2021), on the other hand, revealed contradicting findings, claiming that students mastered crucial competences when using the recommended methodologies for the design step's 2D diagrams. Further evidence of excellent study outcomes came from Philips et al. (2021) findings, which revealed that students were able to create rich idea 2D diagrams from the specimens presented earlier.

This section of the paper previously mentioned a section of the last objective that highlighted the need of determining how e-tutors' capabilities are employed for technologies in the teaching of 3D diagrams of the design step. Some research (Evans & Sonderlung, 2021; and Kounlaxay et al. 2021) highlighted this goal in the study. According to the results of the Ocelo (2021) study on 3d spatial thinking, children exhibited a limited knowledge of 3D shapes as well as difficulty with their attributes. The findings of Ocelo (2021) were similar to those of Evans & Sonderlung, (2021), who found that pupils were unable to produce a 3D fabricated model utilizing a digital tool. The findings of Kounlaxay et al. (2021) suggested that students who took part in the survey were doubtful about their ability to construct 3D items on their own utilizing the digital tool. In contrast to the findings above, the results collected from the students who participated showed that following the use of digital tools, they were able to see the key elements that were kept although they were hidden in one diagram. Yahya, Haj-Yahya (2021). This finding was backed up by a study by Komatsu and Jones (2020), who claimed that digital tools provided a comparable experience, demonstrating that they allowed students to learn more about 3D design. At the same time, according to Formit's (2020) study, a favored digital tool fostered an easy workflow in which students were able to construct 3D diagrams with ease. Teachers said that using technology tools helped pupils better grasp the direction of 3D diagrams, according to a previous study by Benning et al. (2018).

Research Objectives

- To assess e-tutors' abilities to choose technologies that will help them conceptualize the design stage of the design process.
- To determine the e-ability tutors to use digital materials in the design process's 2D diagrams design step.
- Determine the e-tutors' ability to apply technologies for 3D diagrams of the design stage in the design process.

Research Problem

This is one of the main questions this research tries to answer.
How does e-tutors' technology knowledge influence effective teaching and learning of the design step?

Method

Research Design

To answer the main research question, this paper used a quantitative approach to examine five e-tutor sites in further depth. The focus was on the e-tutors' conversations and the students' reactions. All of the conversations were culled using a broad guideline of inclusion that required the chosen to address the technological knowledge part at the very least.

Participants

This study looked at five e-tutors who were assigned to a module with 560 students enrolled throughout the course of a semester. The observations came from exchanges between e-tutors and students at five different e-tutor sites. The five e-tutors were chosen in accordance with policy, which stated that one e-tutor should be assigned to every hundred students. In an instance when this was recognized and given as a criticism, there was some logic that aligned with the paper's quality and objective. After then, each e-tutor site was given a name, such as ETS1, which stood for "e-tutor site number 1." From E-tutor 1 to E-tutor 5 (ET1-ET5), and E-tutor Site 1 (ETS1) to E-tutor Site 5 (ETS5), five e-tutors worked on five locations in this article (ETS5). The names ETS1-ETS5 were supplied in the pictorial depiction.

Research Instruments

This study used a long-term, repeated online observation method that focused on textual interactions for a two-year module program taught at a university. To collect the textual exchanges, non-participatory online observations were utilized as an instrument. The online observations were utilized as a starting point for gaining insights into how the e-tutors' technology knowledge effects the effective teaching and learning of the design step stage. As a result, the online students' interactions with the e-tutors were observed. During my PhD research, I designed, customized, and validated an online observations instrument to capture information from discussion forum platforms. The goal was to create a structured content out of the online postings between e-tutors and students. In the event of a criticism of the instrument, the instrument became suited for the aim of this paper since its orientation was more towards a pragmatic design orientation. The instrument's practical character allowed it to capture the number of frequencies from the e-

tutors' site postings as well as the frequencies of the students' reactions. The researcher's pragmatic nature was also extended when she took a stance to count the number of postings and responses each time they occurred. Printing the postings from the five e-tutor sites for verification reasons addressed the issue of credibility. Two co-workers were provided the documents for verification and further verification.
The instrument appears as table 1 below.

Table 1.
Online Observations Data Table

Knowledge of Different Technologies by e-tutors			
Construct	**E-tutors**	**Postings**	**Responses**
		E-tutors	**Students**
E-tutors use knowledge which provided online students with sufficient opportunities to work with different technologies	ETS1	4	1
	ETS2	2	1
	ETS3	0	0
	ETS4	1	15
	ETS5	3	1
E-tutors used digital materials that map stages of the design process.	ETS1	4	1
	ETS2	1	1
	ETS3	0	0
	ETS4	4	2
	ETS5	2	0
E-tutors know and use technologies that online students can use to understand Technology Education concepts.	ETS1	3	1
	ETS2	1	0
	ETS3	0	0
	ETS4	3	2
	ETS5	4	1

Data Analysis
The descriptive data was derived from five e-tutors' postings, which were read, analyzed, numbered, and prepared for analysis using tables. Three tables were used to organize the assessments of various postings on the sites. Table 1 shows e-tutors' abilities to select technologies to conceptualize the design step; Table 2 shows e-tutors' potentialities to teach 2d diagrams using digital tools to conceptualize the design step of the design process; and Table 3 shows e-tutors' abilities to exploit technologies to teach 3d diagrams for the design step of the design process. Table 1 shows the online observation tool.

Results

e-Tutors' Abilities To Select Technologies To Conceptualize The Design Step

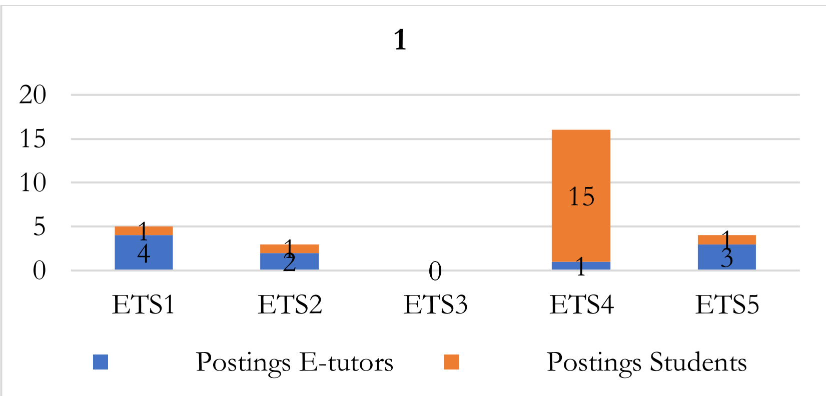

Figure 1.
The Abilities to Select Technologies to Conceptualise the Design Step

Figure 1 shows the results of an item designed to assess an e-ability tutor's to choose technologies for the design step of the design process. The observations documented the responses of five e-tutors (ETS1; ETS2; ETS3; ETS4 and ETS5) to their students' postings. ETS1 posted four times in the table, followed by ETS5 with three postings. In response to the ETS4 ads, fifteen students responded, but ETS1 received only one response. ETS2 posted twice in the same time, receiving only one response from a student. ETS5, who had posted three times on the construct, received a single response from a single student. There were no postings from the e-tutor for ETS3 in regard to the construct's ability to apply technology throughout the design step stage.

The Potentialities of e-Tutors to Teach 2D Diagrams

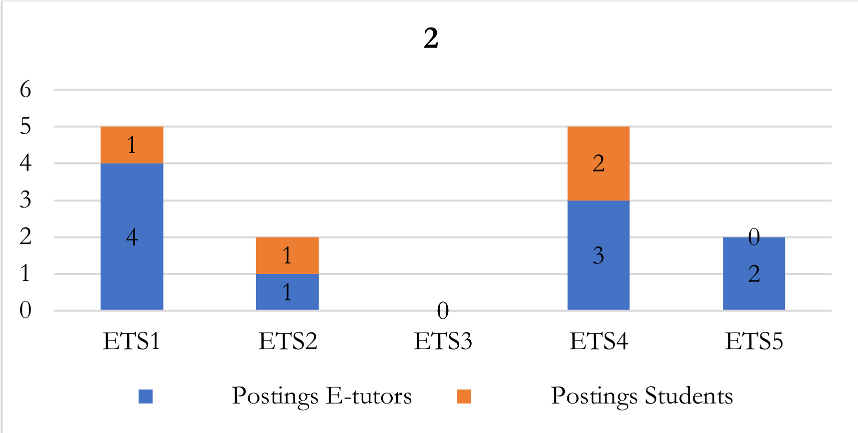

Figure 2.

The Potentialities of e-Tutors to Teach 2D Diagrams Using Digital Tools to Conceptualize the Design Step of the Design Process

Figure 2 shows the responses to a question designed to see if e-tutors have learned how to use relevant digital assets to teach the make stage of the design process. Five e-tutors (ETS1; ETS2; ETS3; ETS4 and ETS5) posted on the construct for the pupils, according to the observations. The e-tutors' postings drew a response from the students as well. A single student answered to each of ETS1's four ads. Furthermore, no student commented to the ETS5's two posts on the construct. ETS4 posted three times, with two responses from the students, according to the table. It's also worth noting that ETS2 only posted once, with only one student responding. Finally, the table indicates that ETS3 did not post for the construct.

e-Tutors' Abilities to Exploit Technologies to Teach 3D Diagrams

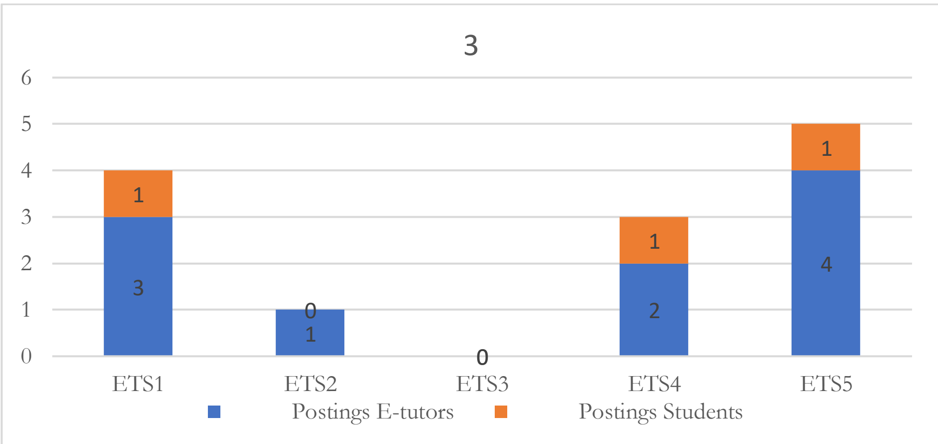

Figure 3.

The Abilities of e-Tutors to Exploit Technologies to Teach 3d Diagrams for the Design Step of the Design Process

Figure 3 shows the responses to an item designed to determine whether e-tutors have acquired knowledge and skills for delivering design process information using online technologies. Only four e-tutors (ETS1; ETS2; ETS4; and ETS5) posted for the online pupils, according to the observations. There's also a breakdown of how students responded to the e-tutors. ETS5 had the highest number of e-tutors postings (4), followed by ETS1 with three listings. In the same way, one posting from student reactions was seen on all three sites (ETS1, ETS4 and ETS5).

Discussions

The presentations of the results in this section were based on table 1.1 for the paper. The findings from research objective 1 show that e-tutors in ODeL settings lack the ability to select technologies to assist students in learning the design step content. This finding is incidental based on the ETS3 from which it was noted that no post was done for the students in relation to the construct. At the same time, it was also evident from ETS4 that a greater number of students responded at fifteen to resounded e-tutor posting. What is observable is that had it been students were given opportunities to respond around digital abilities around their design step by their e-tutor, an opposite of what is observed might have been the case. Tyrus & Harasymenko (2021)and Zhaldak et al. (2021) made similar conclusions in the literature, stating that the pedagogical purpose of tools was not devoted to the cognitive processes of the design step, and that students were exposed to an unorganized transfer of technological abilities. According to Vegliane and Sannicandro (2020), e-tutors' pedagogical technological role did not result in the successful use of technology for the design step. In the worst-case scenario, the students who were the focus of this paper could conclusively demonstrate what Hietajarvi et al. (2020) found: students with extensive technology knowledge had been alienated and disinterested in the module allocated to the e-tutor. There is no broad agreement with the paper regarding engaged and active students who develop knowledge about the design stage, which served as the foundation for the study. In addition to what was previously stated about the purpose of the Technology subject, which was to introduce learners to the fundamentals of the work world and its importance, which is to develop excellence for careers as civil, mechanical, and structural engineers, the two are defeated based on observations in relation to ETS3. According to what is known about ETS3, students that are coached in ETS3 do not develop giftedness in the design process.

Furthermore, there was some more evidence which was obtained according to the students' category of posts, that the e-tutors' technological knowledge is not communicated in order to make the design step process education exciting. With a single potential student posting, this is obvious in ETS1, ETS2, and ETS5. This indicates that teaching in this manner is unfeasible, particularly when it comes to the critical digital abilities required for the design step of the design process. ETS1 had the most number of e-tutors' postings (4), followed by ETS4 with three postings. These findings indicate that e-tutors lack the ability to select digital materials for the stages of the design process taught in ODeL settings. The students' comments show that they only participate in the e-tutors' postings to a limited extent. In ETS1, for example, the e-tutor posted four times and received only one response.

This section of the paper was based on Figure 2 and Figure 3 which were conceptualized for the paper. The next order needed a presentation on the potentialities and the abilities of the e-tutors' presentation of both the 2D and 3D diagrams for the design step. In this paper, these were regarded as content knowledge domain for the design process where in light of the presentations, the e-tutors' technological understanding of the design step features. From which, two of the objectives which were set for the paper were conglomerated in this section of the results. The aim was to combine aspects which relate to how the design step is intended to be taught within the design process curriculum. From which, the two findings show that e-tutors lack the necessary competencies to deliver the design step process using both the 2D and 3D diagrams for the design step material in ODeL settings using online technologies. The claim concerning the two discoveries is based on what has been observed conclusively about two ETS3. One major issue is that students who receive assistance will have distorted knowledge of both 2D and 3D diagrams. The students were not given opportunities to enhance their grasp of both 2D and 3D diagrams, which implies that they were not given opportunities to advance their understanding of both 2D and 3D diagrams. In relation to the characteristics of students who were assisted, such as those who are currently serving as teachers and those who are still undergoing training, According to ETS3, the two cohorts of students will not gain crucial knowledge regarding both 2D and 3D diagrams in the schools where they are appointed or will teach in the future. As a result, what is known from Alok (2021) is perpetuated by ETS3 in that students will continue to perceive both 2D and 3D diagrams as difficult to draw, and therefore such key abilities will be lost. Sung et al. (2019) described earlier correlates nicely with what is seen in ETS3 in that the narrative that the same diagrams taught in engineering and architecture are forgotten when it comes to e-tutors because they teach the diagrams differently to engineers. This contradicts what was said about the subject's importance in terms of preparing students for employment as civil engineers, architects, electricians, and mechanical and structural engineers. From the students, their results, like the e-tutors', suggested that the e-tutors' understanding of online technologies did not get their technological knowledge learning completed, which would mimic their learning of the design step process. The results of a study by Rohendi et al. (2021) confirmed that students found it difficult to go from 3D to 2D visuals. Simultaneously, Serrano et al. (2021) discovered that some pupils only sketched on occasion and only for 2D drawings. In addition, data from Ocelo (2021) on 3D spatial thinking revealed that students had a limited comprehension of 3D shapes as well as difficulty with their properties when it came to 3D diagrams. This was similar to Ocelo (2021), whose findings were similar to Evans & Sonderlung, (2021), who found that students were unable to produce a 3D generated model utilizing a digital tool. Similarly, the findings of Kounlaxay et al. (2021)

indicated that students participating in the survey were doubtful about their ability to design 3d items using the digital tool on their own.

Conclusion

How does an e-technical tutor's knowledge influence effective teaching and learning of the design step? This was the key research topic. Three key objectives were established with the goal of answering the study topic. The first goal was to assess the e-tutors' ability to choose technologies that would help them conceptualize the design step of the design process. The findings revealed that e-tutors in ODeL settings lack the ability to choose technologies that will help students learn the design step process. This means that students who are aided in achieving this goal will be short-changed because their theoretical knowledge of key technology will be limited. A potential issue for the two cohorts of teachers is that they would not contribute significantly to the field by exhibiting competences in the selection of technologies that would aid in crucial insights into the design stage of the design process. Furthermore, because many kids already have extensive cognitive talents and familiarity with technologies outside of school, they will miss out on key world of work prospects. Hietajarvi et al. (2020) further on this by stating that some of them students get alienated and disengaged at institutions. According to findings from studies (Tyrus & Harasymenko, 2021; Zhaldak et al. 2021), the instructional function of tools was not devoted to the cognitive processes of students at a distance, resulting in an unorganized transfer of technological skills. According to Vegliane and Sannicandro (2020), e-tutors' pedagogical technological role did not result in the successful use of technology for the design stage of the design process. The theoretical framework that was used to root the research was constrained by its goals, which were to emphasize the importance of students who are actively involved in the generation of information for the design step.

The second set of findings came from the paper's two aims. From the first to the second aim, the e-ability tutor's to exploit digital materials for the 2d diagrams design step of the design process was assessed. The findings of some studies, such as Rohendi et al. (2021), confirmed that pupils found it difficult to transition images from 3D to 2D Serrano et al. (2021) contributed and discovered that some engineers only sketched once in a while and just for 2D drawings. Less desirable outcomes occurred from the observations for the third and final objective, which intended to identify the e-tutors' potentialities to employ technology for the 3D diagrams, of the design process. The findings revealed that e-tutors lack the requisite skills to deliver the design phase process in ODeL settings using online technologies using 3D representations for the design stage material. The need to examine how e-tutors exploit digital materials and use their potentialities for their students became less heightened within the theoretical framework framed for the paper as the need to examine how e-tutors exploit digital materials and use their potentialities for their students with both need cognitive skills for both the 2d and 3d diagrams became less heightened. Studies (Evans & Sonderlung, 2021; Kounlaxay et al. 2021 & Ocelo, 2021) have found that their findings agree with those in the publication that attracted attention to this goal. According to the findings of Ocelo (2021), pupils' 3D spatial thinking abilities were characterized by a lack of knowledge of 3D shapes as well as issues with their attributes. Evans & Sonderlung (2021) verified Ocelo's (2021) findings, reporting that students found it difficult to create and use digital tools for a 3D produced model. Similar findings were found by Kounlaxay et al. (2021), who found that students in the survey were doubtful about their ability to produce 3D items utilizing digital technologies. These findings highlight to the need for more training opportunities for e-tutors whose appointments help students have a better theoretical understanding of the design stage in the design process curriculum.

Recommendations

The findings in this paper were based on literature, a theoretical framework, and online observations. The online observations ranged from ETS1 to ETS5 and were based on online observations between an e-tutor and the students. It was demonstrated that e-tutors in ODeL settings lack the ability to select technologies that would assist students in learning the design step content, according to the paper's aim 1.

This section stated two objectives for the paper that were combined because each target was particular to two crucial diagrams for the design step of the design process. Two of the findings suggest that e-tutors lack the requisite competences to provide the design step phase within the design process in ODeL settings using online technologies using both 2d and 3d diagrams for the design stage content.

Limitations of the Study

This research was carried out in an ODeL institution with a global student population of 300,000 students. Out of the whole student population, this paper concentrated on 560 postgraduate students who registered for a module (n=560), which proved to be a restriction. There was an additional limitation because the same ODeL institution positioned its qualifications through seven colleges and institutions, although this article is specific to a single college. Despite the fact that departments teach a range of modules, this constraint was likely exacerbated by the fact that this paper focused on only one college and one module within a department. The institutional professional plan for e-tutors provides for e-tutors across the institution, colleges, and departments, which might be regarded a high number of e-tutors and result in a limitation in that only five e-tutors participated in this study. An instrument became a constraint because it was developed and utilized as a practical tool for a certain purpose. Following that, a list of restrictions was published in this document, with no indication that the paper would be accorded little weight or authority. In conclusion, there is a need to examine these restrictions in order to not generalize the findings, but to pay attention to them so that they may be applied to other studies.

Acknowledgement

I acknowledge the e-tutor participants and my mentor.

Biodata of the Author

Dr. Mpipo Zipporah Sedio is a lecturer in the Department of Science and Technology Education (DeSTE) at UNISA. She graduated with a PhD in Technology Education. Her research interests focus on Technology Education and Open Distance eLearning. E-mail: sediom@unisa.ac.za

References

Alok, A. (2021). Sketching- an iterative tool for engineering problem solving. *Journal of Engineering Education Transformation, 34*(4), 51 – 57.

Anamova, R. R. (2021). Engineering and graphic education during and after the COVID-19 pandemic: challenges and opportunities. *AIP Conference Proceedings* 2389, 100007. https://doi.org/10.1063/5.0063501

Baker, A. H., & Kassimer, J. L. (2021). Using a connected learning framework to promote democratic education during a transition to online learning. *Middle Grades Review*, 7(1),1-15. https://scholarsworks.uvm.edu/mgreview/vol7/iss1/2.

Benning, L., Linsell, C., & Ingram, N. (2018). Using technology in mathematics: professional development for teachers. In Hunter, J., Perger, P., & Darrah, L. (Eds), *Proceedings of the 41st Annual Conference for Mathematics Education Research Group of Australia (MERGA) making Waves, Opening Spaces* (pp.146- 153). Auckland.

Department of Basic Education. (2011). *Curriculum and Assessment Policy Statement*. (CAPS). Technology. Grades 7-9. Department of basic Education: Pretoria.

Evans, P., & Sonderlund, C. (2021). Prototyping remotely together with 2d, 3d and immersive virtual reality design tools. *International Conference on Engineering and Product Design Education*. 9-10 September.

Franchuk, N.P. & Prydacha, T.V. (2020). Organization and conduct of classes in educational institutions during distance learning. *Journal of Physics: Conference Series*. 1-11. Doi;10.1088/1742-6596/1840/1/012054.

Han, J., Gu, L. Y., Chen, D. (2021). Application of innovative design thinking in product design, intelligent waste-paper recycling machine design case. 1-5. *E3S Wed Conference*. https://doi.org/10.1051/e3scomf/202123604062

Haj-Yahya, A. (2021). Can a number of diagrams linked to a proof task in 3d geometry improve proving ability? *Mathematics Education Research Journal*. https://doi.org/10.1007/s13394-021-00385-8.

Hietajarvi, L., Lonka, K., Hakkarainen, K., Alho, K., & Salmela- Aro, K. (2020). Are schools alienating digitally engaged students? Longitudinal relations between digital engagement and school engagement. Frontline Learning Research, 8(1), 33-55.

Kieman, N., Manches, A., Seery, M.K (2021). The role of visuospatial thinking in students' predictions of molecular geometry, 1-14. *Chemistry Education Research and Practice*. https://doi.org/10.1039/DORP00354A.

Komatsu, K., & Jones, K. (2020). Interplay between paper-and-pencil activity and dynamic- geography-environment use during generalisation and proving. *Digital Experiences in Mathematics Education*, 6. 123-143.

Kounlaxay, K., Shim, Y., Kang, S. J. Kwak, H. O & Kim, S. M. (2021). Learning media on mathematical education based on augmented reality. *KS11 Transactions on Internet and Information Systems*, 15(3),1015-1029.

Lin, K. Y., Wu, Y. T., Hsu, Y.T., & Williams, P. J. (2021). Effects of infusing the engineering design process into STEM project-based learning to develop preservice technology teachers' engineering design thinking. *International Journal of STEM Education*, 8(1),1-15. http://doi.org/10.1186/s40594-020-00258-9.

Maré, S., & Mutezo, A.T. (2021). The effectiveness of e-tutoring in an open and distance e-learning environment: evidence from the university of south Africa. Open Learning: The Journal of Open, Distance and E-Learning, 36(2), 164–180.

Mohamad, T. (2021). "The eight grids: a new method to enhance students' sketching skills in the schools of architecture. *Architecture And Planning Journal (APJ)*, 27(1),1-13.

Ocal, T., & Halmatov, M. (2021). 3d geometric thinking skills of preschool children. *International Journal of Curriculum Instruction*, 13(2), 1508-1526.

Phillips, C., Sunderlin, D., & Addy, T. (2021). Adapting to new modes of teaching during COVID-19: developing instructional approaches that empower learners and facilitate virtual learning experiences. *Journal of Transformative Learning*, 8(1),10-21.

Pittalis, M., & Christou, C. (2010). Types of reasoning in 3D geometry thinking and their relation in spatial ability. Educational Studies in Mathematics, 75(2), 191-212.

Pownall, M. J., Brook, E. E., & Pashley, K. (2021). H.I.I.T, High intensity ideation training- facilitating group design ideation in a digital space. *International Conference on Engineering and Product Design Education,* 9-10 September, 2021. Via Design, Via University College, Herning, Denmark.

Ravioloa, P., Simoneb, M.G., Mauroc, I., & Rondonotti, M. (2021). *Blended Learning in Online Teaching. Design Strategies and Future Developments*, Proceedings of the First Workshop on Technology Enhanced Learning Environments for Blended Education (teleXbe2021), January 21-22, 2021, Foggia, Italy. https://ceur-ws.org/Vol-2817/paper22.pdf.

Rohendi, D., Utami, N., Anna, A., & Sukandar, A. (2021). Projection simulation media in technical drawing for vocational students. *Journal of Engineering Science and Technology*, 16(1), 385-397.

Serrano, A., Chen, B., Wang, C., Piovarci., Seidel, H.P., Didyk, P., & Myszkowski, K. (2021). The effect of shape and illumination on material perception; model and applications. *ACM Trans*. 40(4), 1-16. https://doi.org/10.1145/3450626.3459813

Smith, S., Talley, K., Ortiz, A., & Sriraman, V. (2021). You want to teach me to engineering? Impacts of recurring experiences on K-12 teachers' engineering design self-efficacy. Familiarity with engineering, and confidence to teach with design -based learning pedagogy. *Journal of Pre-College Engineering Education Research (J-PEER),* 11(1), 26-44. https://doi.org/10.7771/2157-9288.1241.

Sung, T. R., Kelly, T. R. & Han, J. (2019). Influence of sketching instruction on elementary students' design cognition: a study of three sketching approaches. *Journal of Engineering Design*, 30(6), 199 – 226.

Taraszkiewicz, A. (2021). Freehand drawing versus digital design tools in architectural teaching. Global *Journal of Engineering Education,* 23(2), 100-105.

Tyrus, Y. V., & Harasymenko, I. V. (2021). Approaches, models, methods and means of training of future IT-specialists with the use of elements of dual education. *Journal of Physics: Conference Series in Press.*

Vegliante, R., Sannicandro, K. (2020). The role of the e-tutor in the university context and in distance learning: an exploratory research. *Journal of e-Learning and Knowledge Society*, 16(3),76-85.

Xueting, L., Sifei, L., Kihwan, K., Shalini, D.M., Varun J., Yang, M., Kautz, J. (2020). *Self-supervised single view 3d reconstruction via semantic consistency*. asXiv preprint arXiv:203.06473,

Zhaldak, M.I., Franchuk, V.M., & Franchuk, N.P. (2021). Some applications of cloud technologies in mathematical calculations. *Journal of Physics: Conference Series In press*.

Zhang, H., Zhou, H., Zhou, Z., Zeng, H., Zhang, X, Yang, J & Lei, H. S., Han, F.S. (2021). Energy absorption diagram characteristic of metallic self-supporting 3D lattices fabricated by additive manufacturing and design method of energy absorption structure. *International Journal of Solids and Structures*, 226-235.