RE-CONSTRUCTING THE USE OF EDUCATIONAL TECHNOLOGY IN THE DEPRIVED ENGINEERING CLASSROOM

Kehdinga G. Fomunyam
Durban University of Technology

ABSTRACT

The use of educational technology in classrooms is gaining grounds in the world. Educational technologies such as Intercom, Internet use, Email, use of phones and tablets for research, video chats, YouTube video lesson, WhatsApp discussion groups and many others are used today to enhance learning. Despite this rapid embrace and use of technology, the bone of contention in this paper is that engineering classrooms in Cameroon are still being deprived of educational technology. The research sought out to examine the reason for this nonexistence of educational technologies in classrooms as well as state the advantages that accrues from using educational technology in deprived engineering classrooms in Cameroon. Data was collected through semi-structured interviews with final year engineering students and their lecturers, transcribed and analyzed using the qualitative analytical approach. The study reveals that ignorance of the significance of educational technology, fear of being replaced by the new technology, stiff administrative grip on funds for these technologies are some of the reasons why some engineering classrooms are deprived of educational technology. The advantages include: time serving, access to alternative educational materials, audio-visuals, knowledge sharing with distant and foreign students, an increase in on-line course availability and learning activities, the growth of interactive communications usage, a growing dependence on distant interactions and non-face-to-face learning, increasing numbers of international education and business relationships and partnerships. The article recommends that the reconstruction of educational technology in engineering education in Cameroon needs to be embraced by school authorities, and classroom teachers. It should begin with school administrators who should be intentional about introducing this alternative education technology in their institutions.

Key words: Re-constructing, Educational Technology, Deprived Engineering Classrooms

1. INTRODUCTION

The significance of educational technology in a deprived Engineering classroom cannot not be over emphasized. educational technology focuses on the use of computers, information systems, audiovisual equipment, and other media for educational purposes (Rodriquez, 1996). Educational Technology is also called Instructional Technology or Information Technology (IT). Educational Technology is mainly concerned with the narrow spectrum of technologies used for communication and the dissemination of information and teaching through technology, instructing students in the use of a relatively small set of tools developed by technology. According to Toffler and Toffler (1995), the primary goal of Educational Technology in classroom is to enhance the teaching and learning process. An engineering classroom is supposed to be more of a workshop well equipped with educational technology to enable engineering students' access to knowledge far and wide and to practicalize what they learn. Unfortunately, most engineering classrooms in Cameroon are deprived of these educational technologies. This poses a problem to engineering education in Cameroons as young engineers find it increasingly difficult to meet the demands of work upon graduation. Engineering students are supposedly trained to be doers, and problem solvers in the society, but without being trained in the mastery and use of educational technology in engineering classrooms, there is doubt if they can deliver services upon graduation. Over the years, most Cameroonian engineering students have done more of theory than practical in their classrooms. However, the world of today is looking for specialist engineers who would be able to function in the advent of the fourth industrial revolution. People have to look for different and more effective ways of thinking, doing, and reflecting about everyday happenings and activities as well as new ways of acquiring and passing on knowledge. People have to learn to use educational technology in deprived engineering classrooms effectively, in a more focused and exploratory way. Gibson (2002a, p. 3) posits that "the knowledge base of education is changing. Conceptions of how individual learning occurs are changing. The tools available to 'do' education are changing. The roles of teachers are changing. Understandings of what should be learned, who should be learning, how they learn, where they learn, and when they learn, are changing". Since the needs of the society are always changing, there is need to adapt a change of methods and tools of education in engineering education. In the face of these changes, a re-construction of the use of educational technology in deprived engineering classrooms in Cameroon becomes a necessity. This paper explores the necessity of incorporating authentic educational technology in the deprived engineering classrooms in Cameroon. To do this effectively, it is critical to point out challenges or short comings of the inexistence of educational technologies in Cameroon engineering classrooms and proposes best educational technology that can be used to reconstruct such deprived engineering classrooms.

Fomunyam (2014) argues that people have to learn to use the tools at their disposal more effectively, in a more focused and exploratory way to break away from the comfortable pathways of common practice that the changing higher education landscape has made redundant, ineffective, or inappropriate. One method of reacting to this situation is to interact with people who think differently (De Grave et al, 1996), or to establish relationships or partnerships beyond common, everyday interactions. One of such being the use of appropriately selected technologies to achieve expanded course objectives at the same time as transforming the learning model traditionally employed in leader preparation programs. Technology provides the environment within which these alternative learning conceptions can grow, and to provide an experiential base from which future classroom leaders can launch themselves as reflective, technology-sensitive, educational leaders, rather than the managers of educational organizations that the traditional conception of the role has constrained them to

(Khoza, 2016). Gibson (2002) confirms this when he argues that "everything in the world of education is in turmoil or undergoing massive upheaval, restructuring, downsizing, or consolidation. Part of the recent chaos of educational change takes the shape of an increasing emphasis upon virtual learning, an increase in on-line course availability and on-line learning activities, the growth of interactive communications usage, a growing dependence on asynchronous interactions and non-face-to-face learning, and increasing numbers of international education and business relationships and partnerships" (p. 316). These innovations in learning suggests that for engineering education to be relevant and responsive, it must embrace the reconstruction of educational technology represented not only by a focus on technology but a focus on the intent of the learning activity and the way the learning environment is conceived and structured (Kennedy, Judd, Dalgarnot & Waycott, 2010). There is therefore need to strategically position traditionally conceived managerial and leadership practices more solidly in a pedagogic framework grounded in technology to encourage the implementation and reconstruction of the use of educational technology in deprived engineering classrooms be it in Cameroon or elsewhere. Furthermore, the purpose and focus of learning in the 21 century has changed regardless of the discipline and this change is gradually being structured to meet the needs of the 4th industrial revolution. Without the use of educational technology especially in classrooms like those in Cameroon where they have been deprived, such education would become obsolete (Khoza, 2016). The focus on technology enhanced learning would create opportunities for improved educational encounters which would assist in reaching established goals and transforming the activity into more meaningful exchanges and interactions between educators, learners, and partners in the learning process, regardless of their location.

Fomunyam (2018) argues that engineering education worldwide is facing several challenges and these challenges can only be solved through targeted contextual measures which take into consideration the socio-political realities. In Cameroon, the engineering classroom has been deprived of both hardware and software vital for enhanced learning in a country striving to create avenues for sustainable development. Riley (2000, p. 1) argues that "in this new global environment where you can email a colleague in Japan or download a chapter of a book from Paris – we have many more opportunities to learn from each other. This new education era is defined by the freedom of information, a freedom that will surely enhance the power of individuals to make choices about their lives ... this opportunity to learn from each other allows all of us to improve the education of all of our children". Reconstructing the use of educational technology in the engineering classroom becomes paramount in this case because it doesn't only create opportunities for learning but also gives engineering students the opportunity of building educational and cultural capital which makes for better educational encounters. The technology enhanced classroom is one which would give students the resources they need to express their potentials, experiment new ways of solving old problems as they strive to improve the quality of life.

2. THEORETICAL FRAMEWORK AND RESEARCH DESIGN

Since education in the 21 century is no longer about the dispensation of knowledge by the teacher to the student but about the construction of knowledge in the classroom by both the student and the lecturer, social constructivism was engaged as a theoretical framework. Social constructivism speaks to the re-construction of the use of educational technology in an engineering classroom in Cameroon by providing opportunities for the breeding of new ways of learning and engagement on different subjects. Fomunyam (2014) and Lock and Strong (2010) postulate that there is no single universal school for social constructionism, but rather a broad stage with a variety of players and tenets that hold it together universally. They opine that there are five major tenets. This is supported by Elder-Vass (2012), Nawaz (2012a),

Nawaz (2012b) and Nawaz and Kundi (2010). These tenets are further articulated below. The first tenet deals with meaning and understanding as the main feature of human activities. In relation to meaning the focus is on the quality of social experience attained due to the language in use. For without a common contextual language meaning and understanding is impossible. The second tenet is concerned with meaning and understanding whose base or beginning is social interactions. These interactions produce a shared agreement as to what direction the meaning construction should take. The third tenet focuses on the ways of meaning making or construction which is inherently imbedded in social processes and is specific to particular time and place. Such particular situations and our ways of understanding them vary from one individual to the other. These variations can be simple, for example students wishing to use a particular type or brand of mobile phone yet what is regarded as the best phone varies from individual to individual and context to context, or complex or more substantive. For example, Hepworth (1999) pointed out the manner in which western ways of making sense of fasting has changed quite remarkably over the years: medieval women who take up this practice were considered saints who withdrew themselves from worldly pleasures and sustained themselves with heavenly rather than physical nourishment. These women therefore did not relate to their experience using the modern discourse of 'anorexia'. Similarly, the Delphic Oracle was respected for hearing and understanding the voices of gods rather than positioned as schizophrenic. The diverse discourses through which their experiences were available to be constructed and made sense of are both historical examples in diverse relations to very different problems of their modern day compatriots. Engineering students would need to learn, unlearn and relearn these discourses and languages as they move forward in their educational journey. The fourth tenet shows that social constructivists more often than not are interested in determining the processes operating in the socio cultural line of action leading to the production of discourses within which people construe themselves. This is not to refute or ignore the fact that humans have an ability to act in a particular way, but rather the argument is that this ability is rather shapeless. The fifth and last tenet deals with the revealing of the activities or operations of the social world and the political allocation of power which is often done unknowingly in a bid to change existing operations and replace it with something better. This bypasses the notion of philosophers interpreting the world but failing to change it, as engineering students would be able to practically engage with both the software and hardware in the classroom as they strive to develop themselves.

This research was driven by the need to reconstruct the use of educational technology in engineering classroom. To explore this phenomenon, a research design was constructed which enabled the researcher to generate a particular kind of data which explores the use of educational technology in the classroom and the need for specialized educational technologies designed specifically to enhance learning. This research was designed as a qualitative case study research. Qualitative research according to Vanderstoep and Johnston (2009) refers to research that probes into an individual's understanding and interpretation of his or her experiences with the aim of grasping the depth in every participant's story. Case study research on the other hand according to Neumann (2006), is ''an in-depth study of one particular case in which the case may be a person, a school, a group of people, an organization, a community, an event, a movement, or geographical unit'' (p. 40). Qualitative case study research therefore seeks to bring together action and reflection, theory and practice in participation with others in the pursuit of practical solutions to issues of pressing concerns to people and more generally the flourishing of individual persons and their communities. Qualitative case study seeks to unearth every detail about a phenomenon in the bid to develop a comprehensive or concrete understanding about its working. Within the qualitative case study approach, data was generated using semi-structured interviews and open ended

questionnaires. The sampling of participants to participate in both the interview and the open ended questionnaire was purposive. The researcher has carefully chosen them with the understanding that they have an understanding on the phenomenon being explored. A total of 116 students responded to the questionnaire and four teachers were interviewed. The data generated was coded and categorized into themes. The themes are presented and discussed in the subsequent sections.

3. FINDINGS

The data was generated coded and categorized into themes. These themes were; outdated educational resources, deprived classrooms and lack of technological know-how. These themes are explained and substantiated with direct quotations from the participants.

4. OUTDATED EDUCATIONAL RESOURCES

As the world evolves, the technological tools within it evolve with it and more and more educational establishments are embracing these tools and innovation to drive the construction of knowledge, however, this is not the case in Cameroon. This rapid embrace of technologies of the changing times and the impact of these new educational technologies on classroom learning cannot be questioned especially because of its ability to provide further learning opportunities which would have otherwise not existed. Educational technology be it software or hardware has the potential to wide access to information, storage, and transmission of information which will in turn generate new learning environments and will lead to a redefinition of where and how learning occurs in engineering education. But most institutions are yet to adapt into this wave of technology enhanced learning. If in case where attempts have been made, the quality of the technological tools obtained are terrible. Speaking about this, one of the lecturers pointed out that "the president of the nation Mr. Biya Paul, made a decree that all university students would be getting computers. However, when the laptops were presented to students, the capacity was so small that most cell phones could work better and faster than it. Most students used it for less than a month and couldn't use it again because of the storage capacity for it contained only a 32 gig ram". Another student supported this by pointing out that "not everyone got the computers provided by the state even though it was meant for children in the primary school. Even the computers in the school cyber are few in number and very slow. All there is a chalk board and the lecturer is expected to bring his or her own chalk". The outdated nature of the technological resources which are available within the university make it increasingly difficult for engineers to get the best or quality education from the university. Another student added that "the few software that are made available for us in engineering are very outdated versions. The university claims it doesn't have money to renew licenses". Another lecturer concluded that "the machines engineering students have to work with be it electrical engineering or mechanical or civil or computer, are very outdated. For the past three years, no new machine has been bought. There is no digital machine in our labs. Our labs look like dumping ground for rubbish". The educational resources available in the engineering classroom are outdated and overburdened and create the need for reconstruction in such classrooms.

5. DEPRIVED CLASSROOMS

Classrooms in the 21 has seen a shift from the traditional classrooms with chalkboard to the more digitally friendly one, fitted with technological equipment like white boards, digital access, overheard projectors, internet infrastructure amongst others. In Cameroon, the engineering classroom have not experienced the same shift. It remains deprived of the educational technological boom ravaging the higher education sector. Pondering about this,

one of the participants pointed out that "our classes are overcrowded and there are no microphones for the lecturer to use. He has to shout at the top of his voice and more than a quarter of the students can't hear him especially those standing by the door or outside". Another participant added that "lecturers have been made burdensome on the students because the classrooms look like town halls where people gather to should at each other. We are in the digital age, training engineers for the fourth industrial revolution. How can we train people for a technological revolution without having the basic technological tools required for technology enhanced learning?". The deprived nature of the classroom necessitates the reconstruction of the use of education technology in engineering education. If any discipline needs its classroom to be technologically enhanced, it would be engineering because of its heavy reliance on software. Supporting this, one of the participants pointed out that "we can do drawing in class because the students don't have access to computers and the few who have don't have access to the most recent software which the institution keeps failing to provide. Things like drawing is practical but without resources, students can't see or do what they need to do. They are limited to see a clumsy illustration on a paper or on a card board which hardly translates to what is currently being done for the engineering world". Another participant concluded that "when I compare classrooms in the university where I was before moving to this country, I feel the ones here have been abandoned because it lacks all basic technological infrastructure. It's like it wants us to remain in the analog world while the digital one gradually passes by". Depravity is the reality of engineering classrooms in Cameroon and re-constructing the of the use of education technology is one way of addressing these challenges.

6. LACK OF TECHNOLOGICAL KNOW-HOW

It is one thing to possess educational technology and another thing to understand how to use it. No matter how terrible the resources are, a perfect command of know-how would be able to savage something out of it. As a result of lack of educational technology there have been little or no opportunities for lecturers to update themselves on how to use basic technological tools or programs vital for their courses. Speaking about this, one of the participants pointed out that "because these technological gadgets are very few and barely working, very few people have been retained to ensure it works or remains in good condition. A faculty might have three or four projectors being used by more than forty lecturers and when one of these are broken, it would take technocrats from outside the university to fix it while there are mechanical and hardware engineers on campus. The lack of know-how on the function of the basic technological tool is amongst the challenges facing the engineering classroom". Another participant added that "the lack of know-how has made some lecturers to be unable to tape into the tools available today. Almost every student has a digital or an android phone with capacity to do a variety of things. With an understanding of technology enhance learning, lecturers can begin to use them to enhance their teaching experience rather than complaining about the resources the institution or the government is failing to provide". Know-how is key in every technological venture. Without a command of know-how, lecturers would not be able to use the technological resources made available to them or use the new ones if they are ever sourced. Another participant further added that "lecturers need to be taught on how to use the available while waiting for the desirable. If they can use everything at their disposal to enhance teaching and learning, then the challenge would have been overcome". Without an understanding of what to do with technological gadgets they will never produce the kind of results desired. Students and lecturers alike must constantly be updated on the use of these technological tools as a way of improving engineering education.

7. DISCUSSION OF FINDINGS

Khoza (2013) posit that there has been a shift from the traditional classroom with chalk board to a more technologically enhanced one which empowers the student to have multiple experiences, access different data sources, and provide instant feeding back all at the same time during teaching and learning. This educational technology provides the means for transforming the role of teaching and learning in educational contexts. Educational patterns are changing and massive increase in access to information resources now occur without any recognized sector of society championing the change. For instance, a Cameroonian engineering student can through the use of the internet on his/her phone, quickly access millions of files on a particular subject in the classroom. In engineering education, the focus is shifting from the all-knowing lecturer and a passive student to the process of co-construction and discovery in the learning process and to action generated by the students from the learning process. The recent information and telecommunication technology revolution has rendered the traditional learning infrastructure irrelevant, creating potentials for communities to learn together and share resources in non-traditional ways is immense.

The three themes which emerge from the findings; outdated educational resources, deprived classrooms and lack of technological know-how all point to the fact that there is need for the reconstruction of the use of educational technology in the engineering classroom in Cameroon. Nawaz and Kundi (2010) argue that improving educational delivery is a core focus of reconstructing the use of educational technology in the deprived classroom, and also a priority for training new generations of teachers in engineering. There is a need for more equipment classes which would provide lecturers with the opportunity to enhance their delivery of the content. However, even beyond the upgrade of classrooms, lecturers need to make use of what is available by tapping to basic technological tools like Facebook, WhatsApp, Google forms, YouTube amongst others. Software like WhatsApp and Facebook can be used with minimal data and most students are already familiar with its interphase. YouTube videos can also be downloaded and used in the classroom or made available to students. This is supported by Shah (2016) who points out that educational technology provides alternative learning platforms which allows lecturers and students to share ideas, post videos, create virtual "labs," and assess student learning. Lecturers can generate instant feedback from students through Facebook or Twitter polls for example if the institutional lacks the financial resources to purchase clickers. Reconstructing the use of educational technology in the engineering classroom in Cameroon therefore center around making use of what is easily available, rather than waiting for the university to upgrade such classrooms which might never happen. Technology is everywhere and it is the lecturer's understanding of these technological tools that determine how he or she might use them in the classroom.

Nawaz (2012a) argues that educational technology enhances teaching and learning efficiency by ensuring that existing processes are carried out in a more cost-effective, time effective, sustainable or scalable manner. It also ensures that teaching and learning is enhanced by providing tools that ease understanding and the realization of expected outcomes. Ensuring that educational resources remain up to date is critical if teaching and learning is to be responsive. This is because educational technology helps build social capital for students most of whom are lacking in the same. Lee, Sun, Law, and Lee (2016) confirm this when they opine that remote access, unlimited availability, and rich resources are the main reasons why educational technology is vital for teaching and learning in the 21 century. They continue that functional educational resources would ensure the personalization of the learning progress since it motivates students, increases learning interest and intention, and leads to better learning outcomes. Being able to learn anytime and anywhere are also obvious practical advantages of educational technology. When classrooms are deprived of educational

technology, the institution is indirectly depriving students of educational experiences which they would have otherwise gotten through the diverse opportunities offered by educational technology. Helping lecturers' development competence in educational technology is also critical in the drive to make engineering education responsive. This is because the technical know-how would help them make use of already existing technology as well as tap into the available ones which have been lying fallow. Sevillano-Garcia and Vazquez-Cano (2015) concur with this when they postulate that digital mobile devices had penetrated the age group 18–26, thus providing enhanced learning opportunities for college students in terms of self-regulated learning, and communication and interpersonal skills development. These devices which are easily available are technological tools which can increase learning motivation, and enhance learning outcomes when combined with appropriate instructional strategies. This is confirmed by Hutchison, Beschorne, and Schmidt-Crawford (2012) who "found that using the iPads for literacy instruction not only supported student learning, but students were also highly engaged and able to demonstrate unique and creative ways of responding to text using a technology tool that offers some unique affordances to users" (p. 23). These devices help improve the quality of learning since students can easily access online resources while in the classroom to buttress their learning experience as well as encourage socialization of reading and user participation. Readily available technological tools like mobile phones, tablets, laptops amongst others provide opportunities for technology enhanced learning in the engineering classroom because of its numerous characteristics like portability, search-ability, and multimedia characteristics as other advantages that have made e-readers very popular and useful in educational settings. Thus, the e-reader has received considerable attention from scholars in educational settings.

Watulak (2012) and Oh and Reeves (2014) conclude that educational technology can increase students' involvement in their courses, and the application of the advanced technological tools especially in engineering education where it is needed can deepen students' learning experiences, by improving student attendance, enhancing learner engagement, and giving students intense experiential learning opportunities. The interaction between engineering lecturers and students in social media platforms or the integration of students' personalized module when applying educational technology may be effective ways of increasing their engagement and enhancing their experience. It is vital that engineering education in the 21 century be social, active, contextual, engaging and student-owned because these are important elements in enhancing students' experience.

8. CONCLUSIONS

Re-constructing the use of educational technology in the deprived engineering classroom in Cameroon is therefore a must, if the nation must achieve its dream of becoming an emerging economy by 2035. Engineering in the 21 century cannot function without technology and these technological skills are garnered during engineering education. Educational technology offers alternative platforms for learning and engagement in the educational sphere which aims at improving educational infrastructure for success in education. Approaches to education keep changing in the 21 century and educational technology can support the changing student-based learning classroom. Educational technology facilitates learning and improves access through distance education, virtual learning opportunities, and electronic learning technologies which make for better educational encounters in the engineering classroom. Reconstructing would provide opportunities for professional development in the process of supporting a new way of thinking about educational technology. The use of educational technology in classrooms is gaining grounds in the world. Educational technologies such as Intercom, Internet use, Email, use of phones and tablets for research, video chats, YouTube video lesson, WhatsApp discussion groups and many others are used today to enhance

learning. Despite this rapid embrace and use of these technologies, the bone of contention in this paper is that engineering classrooms in Cameroon are still being deprived of educational technology. The research sought to explore this phenomenon and make recommendations for improvement so as to make engineering education responsive. Data was generated using semi-structured interviews and open ended questionnaires. The data generated was coded and categorized into three themes; outdated educational resources, deprived classrooms and lack of technological know-how. From the findings, this paper concludes with three key recommendations.

Firstly, educational technology is at the center of engineering education in worldwide and this should be the case in Cameroon as a way of making its engineers globally relevant and contextually useful in driving Cameroon towards become an emerging economy. Without educational technology engineering graduates in Cameroon would never been effective because they would lack the skills to function in the ever changing world. Secondly, engineering classrooms in Cameroon require immediate attention and upgrading with new and functional technology which would make for better educational encounters in their quest for knowledge. How conducive a classroom is, would determine the kind of educational engagement between the students and the lecturer. By reconstructing the classroom with technological tools that make for better educational experiences, the university would be ensured that engineering graduates have the best educational encounters. Lastly, institutions need to ensure that both their students and staff get proper training on the use of educational technology. Engineering is about improving the quality of life and with the revolution in artificial intelligence, engineers cannot afford to function in a technologically advanced world without technological skills. To improve the quality of life within the frame work of the fourth industrial revolution engineers must possess technological skills which make better educational experience and professionalism.

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