Chapter #10

4th IR – THE IMPACT THE USE OF MOBILE TEACHING DEVICES WILL HAVE ON HIGHER EDUCATION

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ABSTRACT

Students and lecturers use mobile devices more and more and within a few years they will become indispensable tools in the classroom. Recent research clearly indicates that mobile devices such as smartphones, laptops and tablets are the tools of choice for students, scholars, teachers, and lecturers. It is playing a major role in teaching and learning, especially in higher education. It is therefore indisputable that the development of artificial intelligence and new ways of communication take their place in the classroom during the 4th IR. The integration of these new technologies into the teaching and learning experience in the classroom will be dependent on effective pedagogical implementation and planning to be successful. Taking this into account, this paper explores the effect that mobile devices have in the classroom on the teaching and learning experience of the student as viewed from the student's perspective. The advantages of the implementation of mobile devices must be weighed against the negative influence they may have. All the participants in the study reported that they have access to and use mobile devices to use the internet to source information.

Keywords: mobile technology, 4th IT, 4th industrial revolution (4th IR), higher education.

1. INTRODUCTION

During the 4th industrial revolution (4th IR) the world will see the emergence of a new form of higher learning institutions. These institutions will have no classrooms, no library, and no on-site lecturers. The institutions will be inter-disciplinary, will have virtual classrooms and laboratories, the library will be online, and the lecturers will either be virtual or located anywhere in the world. Higher Education in the 4th IR is creating an exciting but complex opportunity which has the potential to transform society for the better. Artificial intelligence is driving the 4th IR and the needs of the workplace will be transformed from task-based orientation to human-centred characteristics. Due to the merging of "man" and machine, the distance between social sciences and humanities as well as between technology and science will be reduced. This will necessarily require more interdisciplinary teaching, research, and innovation. All the components of the "new" higher education system will be inter-dependable of each other but will also remain independent of each other.

2. PURPOSE

The purpose of this study is to explore and assess how mobile devices affect students' learning, participation, and engagement in the classroom. Mobile devices are an indispensable part of everyday life and therefore the devices are in the classroom every day. The main purpose of higher education will always remain the same, namely, to ensure quality

of learning via teaching; to enable the students to be exposed to technology and the latest knowledge through research, and innovation to sustain the development of societies by means of service. One of the foremost tasks of every university is to educate and prepare the youth. Therefore, it is necessary to use the most appropriate, current, and innovative teaching strategies and to organise the teaching experience in a way that promotes learning. These have implications for learning programmes, better learning experience, and the cultivation of lifelong learning attitudes. The impact of the 4th IR and the utilisation of mobile teaching devices on higher education need to be researched and understood. The question is what the impact of the 4th IR will be on higher education.

Numerous opportunities are created today with the rapid advancement of information technology to take advantage of technology in the "new" world where boundaries and borders do not exist anymore, and in which communication has become instant and immediate. A mobile device is defined as "*a portable computing device such as a smartphone or tablet computer*" (Fasae & Adegbilero-Iwari, 2015) and has become one of the best innovations of the 3rd IR, but will still have a major role to play in the 4th IR. iGen (people born between 1995 and 2013) has developed the ability to multi -task and not only multi- task but to switch between different tasks. However, Greenhow and Askari (2017) state that individuals who multitasked performed poorly on tasks in comparison to those who performed the tasks one after the other. This view is shared by several researchers who have proposed that human beings are truly not adept at multitasking but do have the capacity to change efficiently from one action to the other (Kirschner & De Bruyckere, 2017). They also mentions that the students' increased access to new technology and the Internet advocates the need for schools to give more attention to the impact of mobile technology on multitasking, learning, and student engagement. Because students will have mobile devices with them, they will be talking, downloading information, browsing, chatting, uploading, or even recording the lecture in class: ALL at the same time. This will have a huge impact on the classroom dynamics and therefore needs to be investigated and the influence thereof determined (Kearney,Burden, & Rai, 2015).

3. LITERATURE REVIEW

Our society has been transformed by technology which has changed our lives irreversibly over the last 25 years. In the education and training environment, technology and especially mobile technology has become an essential tool for the modern student. The digital age caused an upsurge in access to information, as well as increased and immediate interaction between people. Bilbao-Osorio, Dutta, and Lanvin (2013) explain, in their study on the state of global information technology, that the number of mobile subscribers will reach 6.9 billion worldwide in the year 2020. They indicated that the use of mobile technology in the form of tablets, phones and laptops is on the increase at all universities and even schools.

Technology is shaping the way that students learn and think. Students insist on using technology in all aspects of their learning experience and, therefore, prefer to multitask and have non-linear access to information quickly. They rely on technology to acquire information and perform social and business interactions (Henderson, Selwyn, & Aston, 2017).

4. ROLE OF TECHNOLOGY IN LEARNING

Researchers have indicated that student engagement is the aspect of learning that focuses on the activities in which students are involved during their studies and which promote learning and result in their academic achievement (Sidelinger, Frisby, & Heisler, 2016). While researching student engagement, researchers suggest that the main objective of education is for students to construct their own knowledge (Covington, 2017; Sidelinger et al., 2016). Therefore, a research study which examines the influence of mobile devices on learning, engagement, and performance shall be relevant and valuable.

A study done by Greenhow and Lewin (2016) concluded that the use of social media in the classroom supported the students' ability to connect to each other, creating a classroom community that increased engagement and facilitated learning. The study showed a relationship between technology and learning: on a general basis, students with a higher use of Information and communications technology (ICT) have a slightly higher performance compared to their colleagues who do not embrace technology in their study methods. Technology improves student engagement and proves to be effective as an intervention for improving learning (Higgins, Xiao, & Katsipataki, 2012). They also stressed that in any case, technology should not replace normal learning, but rather be used to supplement learning, and this implies that students should be attentive in the way they use technology for learning. BrckaLorenz, Haeger, Nailos, and Rabourn (2013) found that technology facilitates increases in collaboration, engagement, and learning in higher education. Technology has altered the iGen generation's approach to reading, learning, problem-solving, as well as information processing. It became important to allow students to make use of what they are familiar with and what they see as the best way to enhance their engagement on campus while joining forces with their peers to acquire new information and to enhance their learning experience (Howe & Nadler, 2010).

Jones, Johnson-Yale, Millermaier, and Perez (2009) did a survey based on the feedback given by 7,421 respondents from 40 universities and colleges on the familiarity and use of the Internet. The results indicated that 85% of the students reported a positive enhancement of their learning experience because of the Internet. Their research identified some of the ways in which technology is incorporated at those institutions to enhance learning. Course management software is one of the methods that increases the efficiency of course material distribution and offers an opportunity for more online interaction between students and lecturers. Student interaction with technology goes beyond just surfing web pages and email but has increased the opportunities for university students to engage with their faculty, classmates, course material and administrators (Howe & Nadler, 2010). The utilizing of mobile devices for access to and distribution of information in higher education redefined the manner in which teaching, and learning takes place but also presented new opportunities for effective student engagement.

5. MOBILE LEARNING - M-LEARNING

Samad, Ihsan, and Khalid (2021) discuss mobile learning, especially during the Covid-19 pandemic and how it has become an indispensable tool in the hands of educators worldwide. They describe M-learning as a learning method that uses mobile technology applied in teacher teaching and learning. The flexible mobile nature allows this learning to be carried out easily, regardless of time, place, and distance boundaries. M-learning is about using the massive growth of mobile technologies to benefit learners and learning. As computers and the internet become essential educational tools, the technologies become

more portable, affordable, effective, and easy to use. Using portable computing devices (such as laptops, tablet PCs, PDAs, and smartphones) with wireless networks enable mobility and mobile learning, allowing college teaching and learning to extend to spaces beyond the traditional classroom. Within the classroom, mobile learning gives university instructors and learners increased flexibility and new opportunities for interaction (Alam & Aljohani, 2020).

The role of the student and the lecturers regarding m-learning is described as follows:

Students – need to be actively involved in accessing information when needed and they need to take responsibility for their learning.

The lecturer – lecturers need to present the learning material in a form that the students can access on the mobile devices. The lecturer needs to be qualified and able to use the platform, they need to determine the strengths and the weaknesses of the methods and then adapt them to be more productive. They need to act as facilitators and advisors to install trust of the method in the students.

M-learning is a part of e-learning, but according to Samad et al. (2021), there are six characteristics distinguishing the two. The six characteristics are shown in the table 1 below:

Table 1.

Characteristics	M - Learning	E – Learning
Device ownership	Privately owned by the student	Owned by the university or institution of privately owned PCs at home
Knowledge	Created through learning content / material and peer interaction	Gained through cognitive processes and inquiry
Learning Context	Formal and informal learning anywhere and at anytime	Formal learning in the classroom and at home
Forms of learning	Personalized learning, situational learning, and authentic learning, discovery, access, and knowledge creation	Students access courseware and materials online, for learning
Learning materials	Courseware is delivered via LAN or CD ROMs or other storage devices, and learning materials on the internet via learning management systems (LMS)	materials are sent via LMS and the internet or even WhatsApp. Students also generate content through discussion and interaction.
Mobility	Access learning materials without time and place from the internet.	Access learning materials using a Local Area Network (LAN) or a compact disc

M-Learning is the tool that provides the learning material for students and teachers on mobile devices. These devices make the lives of people easy and are already part of people's daily lives. The use of mobile technologies to support, enhance and improve access to

learning is a relatively new idea and while many teenagers and twenty plussers are expert mobile phone users, many lecturers are not. Mobile technologies can support learning experiences at university level that are collaborative, accessible, and integrated with the world beyond the classroom educative learning initiative.

6. THE EFFECT OF MOBILE TECHNOLOGY ON ACADEMIC PERFORMANCE

Radesky, Schumacher, and Zuckerman (2015) argue that mobile devices do have a noteworthy influence on academic performance, mainly by causing distractions. However, several studies found that mobile technology does not have any effect on the students' academic performance (Heflin, Shewmaker, & Nguyen, 2017; Rabiu, Muhammed, Umaru, & Ahmed, 2016). Student performance was linked with cell phone use during class time in a study by Duncan, Hoekstra, and Wilcox (2012). They found an average negative grade difference of 0.36 ± 0.08 (on a four-point scale) for students who reported regular cell phone use in class. Information from the same study revealed that students accessed their phones at a rate of seven times per class period.

McCoy (2016) conducted a study to define students' behaviour and insights regarding the classroom use of digital devices for non-class purposes. A total of 777 students at six US universities took part in the study. The average student used a digital device for non-class purposes 10.93 times during a typical school day for activities including texting, social networking, and emailing. Most respondents did so to fight boredom, entertain themselves, and stay connected to the outside world. More than 80% of the respondents indicated that such behaviour caused them to pay less attention in the classroom and thereby miss instructions. Most respondents indicated that they favoured policies governing digital device distractions in the classroom.

In a study conducted by Sundari (2015), it was found that there was a direct correlation between mobile device use and students' learning skills. Students who used technology performed better than those students who did not use technology. Mobile technology has been the most popular communication channel for individuals in tertiary institutions. However, studies have shown that extensive use of technology such as social networking, chatting, and texting on students' mobile phones during class time contributed to lower grades and overall poor performance. On the other hand, Sundari recognized that students' use of technology improved their learning because it assisted them to exchange information with their peers regarding their studies. While some researchers indicated that technology can negatively impact students' performance when used in class, other studies have shown that technology may have a positive impact on student performance (Radesky et al., 2015; Tindell & Bohlander, 2012). Vázquez-Cano, Gómez-Galán, Infante-Moro, and López-Meneses (2020) agree with them on the negative impact that technology has on the impact of student performance except for their reading ability that declines.

Rabiu et al. (2016) conducted research on the impact of mobile phone use on academic performance. The researchers found that the use of mobile phones had a significant effect on students' academic performance by acting as a source of distraction. However, a noteworthy number of the respondents stated that mobile phone use does not have a notable effect on their performance (Rabiu et al., 2016). Mobile technology provides a platform for interaction and collaboration among students.

Currently during the 4th industrial revolution, researchers are beginning to explore the potential of mobile technologies and devices to support learning (Golenhofen, Heindl, Grab-kroll, Messerer, & Böckers, 2019). Developments in the field of mobile technology are

prompting the design and development of M-Learning projects. In addition, efforts and studies were also taken to design courses and build materials suitable for mobile devices (Hanbidge & Tin, 2020; Utesch, Faizan, Krcmar, & Heininger, 2020)

7. EDUCATIONAL BENEFITS OF MOBILE DEVICES

It is time that we start thinking of cell phones as computers. The description of cell phones seems unclear. Several terms are used by researchers such as cell phones, mobile phones, portable media players, tablet computers or smartphones (Al-Emran, Elsherif, & Shaalan, 2016). In an academic setting there are many effective uses for cell phones, such as supplementing the class experience and getting tutoring assistance from instructors (Tao & Yeh, 2013). They found in their study that using cell phones to augment teaching helped increase the quality and quantity of student feedback. Students use their mobile devices to access other media such as the Internet, Facebook, Twitter, YouTube, and other information communication technology. Bannon, Martin, and Nunes-Bufford (2012) suggest that the use of social media by college students ages 18 to 34 was increasing. Gikas and Grant (2013) explored the process of integrating mobile technologies into teaching and learning. The faculty members at the institutions where they conducted their research incorporated mobile technologies into their courses. They concluded that the use of mobile technologies in these institutions of learning resulted in positive outcomes that would make learning a meaningful and fruitful experience for the students.

Keane, Lang, and Pilgrim (2012) classify the educational benefits of mobile devices into seven categories. One of the benefits is that mobile devices serve as a tool to access multimedia. Students have access to analytical tools or can use the mobile device as an assessment tool in the completion of examinations, questions and quizzes. A second category of educational benefits of mobile devices is their use as a managing tool. Students can manage their personal information such as task lists, calendars, and address books. Students use the mobile devices in the class to conduct research, use the word processor, produce presentations, and complete quizzes or tests. Some lecturers and students have stated that use of mobile devices could increase student engagement and academic performance (Bannon et al., 2012). However, the impact that the various forms of technological innovations may have on students' academic performance remains an issue. Thus, further investigation into understanding students' uses of mobile devices in the classroom and the influence on engagement and learning was needed.

8. METHODOLOGY

An integrated methodology, the FraIM (Framework for an Integrated Methodology) was followed for the research. FraIM integrates qualitative and quantitative methods in a way that is argued will enable a researcher to employ a mixed methods approach with any research project (Plowright, 2011). It is appropriate for carrying out small-scale empirical investigations that are aimed at evaluating, developing, and improving an understanding of practice. It can be applied to research undertaken for a programme of study in a university setting. It can also be deployed to solve problems in a variety of professional, vocational and workplace contexts and locations (Fourie-Malherbe, Aitchison, Bitzer, & Albertyn, 2016).

The main data used in this article stem from interviews and questionnaires with students from the Central University of Technology, Free State, registered for BEd SP & FET, Specialisation: Technology, on their views of the 4th IR's impact on the higher education system and the use of mobile teaching devices.

9. LIMITATIONS

The sample group was small- and the time frame was limited. Another limitation was access to all the new technologies that are available to demonstrate and for students to have hands- on interaction (Rossing, Miller, Cecil, & Stamper, 2011). The target group consisted of 85 students (52 females and 33 males) enrolled in the 3rd year of the BEd (SP & FET) Technology qualification.

10. FINDINGS

This research focused on how the 4th IR impacted on students' engagement and learning in the classroom using mobile devices.

Figure 1 presents the types of mobile devices that the participants in this study owned. According to the data, 100% of the participants indicated that they owned smartphones, tablets, or personal computers and used them often.

Figure 1.
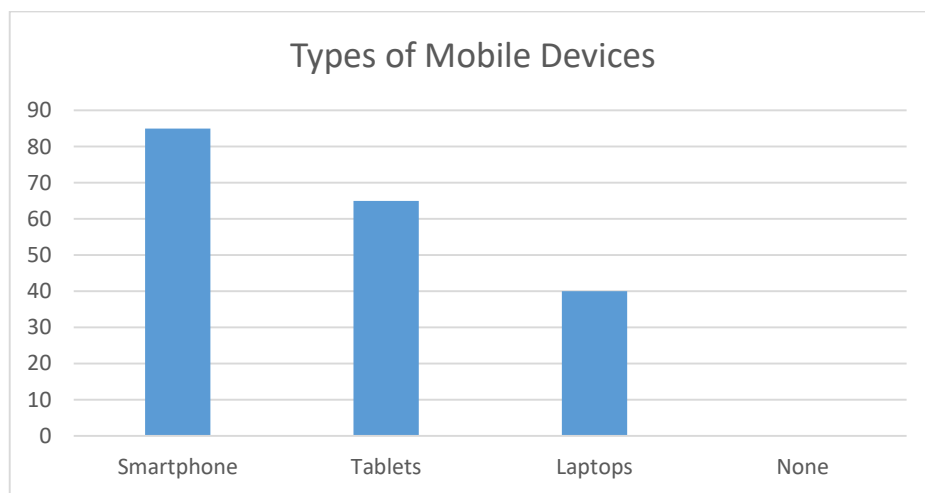
The data clearly show that all students have access to mobile devices with at least 1 of the types of devices, whereas most students own 2 or even 3 types.

Figure 2 presents the comfort level of participants with using mobile devices in the classroom. According to the data, 75.3% of the participants were comfortable or very comfortable using mobile technology.
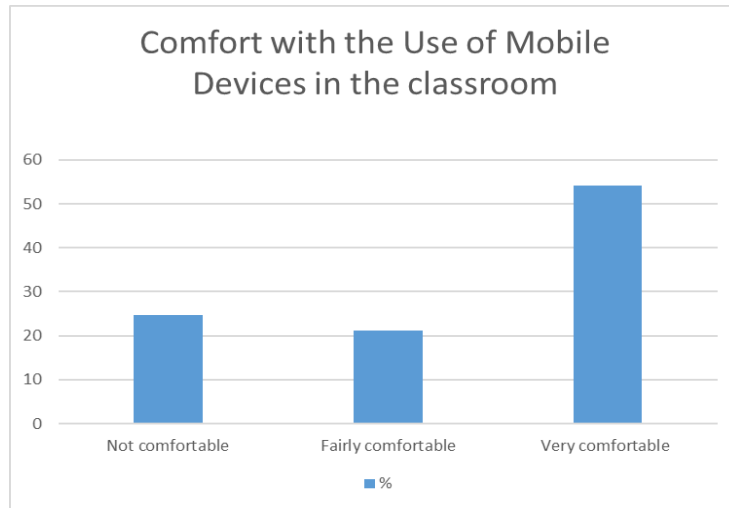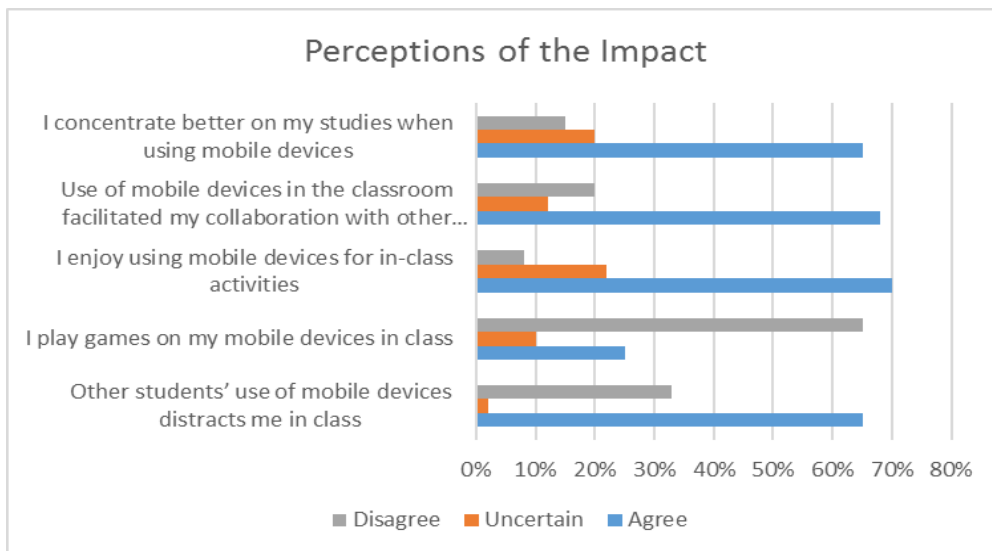
Figure 2.

Figure 3 provides a summary of the participants' perceptions of the impact of their use of mobile devices in the classroom on their level of engagement and learning. The findings are presented below:

Figure 3.

1. 65% of the participants reported that other students' use of mobile devices distracted them from paying attention in class, while 33% disagreed with this notion and 2% of the participants were uncertain. This finding indicates that the use of mobile technology by some students in class distracted other classmates from paying attention in class.

2. 25% of the participants reported that they played games on their mobile devices in class, while 65% disagreed with this and 10% of the participants were uncertain. This finding indicates that a quarter of the participants did not constantly focus on learning in class.
3. 70% of the participants reported that they enjoy the use of mobile devices for classroom activities, while 8% disagreed with this notion and 22% of the participants were uncertain. The participants reported that they enjoy the availability of more information than what is given by the lecturer.
4. 68% of the participants reported that the use of mobile devices in the classroom facilitated their ability to collaborate with other students, while 20% disagreed with this notion and 12% of the participants were uncertain. This finding indicates that many of the participants were able to collaborate with others, using mobile devices in class.
5. 65% of the participants reported that they concentrated better on their studies when using mobile devices, while 15% disagreed and 20% were uncertain. The participants who reported that mobile devices helped them to concentrate more on their studies validated this by stating that they could confirm the validity of the information received while learning, they could easily connect with their peer groups, take notes in the class, and get informed videos for better understanding their studies. Thus, this finding indicates that many of the participants concentrated better on their studies when using mobile devices in class.
6. 48% of the participants reported that they access social media in the classroom during the lecture, while 30% disagreed and 22% were uncertain. This finding indicates that many of the participants do not pay attention in class when using mobile devices.
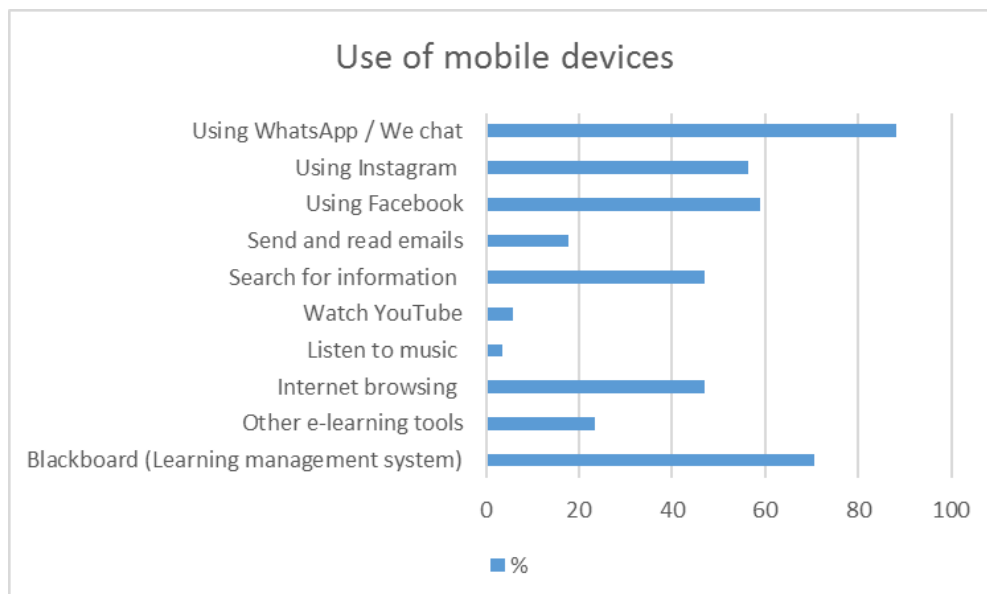
Figure 4.

Figure 4 provides data on the use of their mobile devices by participants during class. Participants could mark more than one option.

More than 70% of the participants reported that they do use their mobile devices in class to access learning material online in the classroom during the lecture, but the worrying factor is that up to 75% of the participants use their mobile devices in class for non-academic purposes.

Figure 5 provides data on the type of mobile device used in class by participants. 82.3% of the participants reported that they use their smartphone in class to access the information needed, but the small screen of the smartphone is seen as a problem, and it makes it difficult to read the notes. Only 2.4% use their laptops in class and the main reason for this is the lack of power outlets to charge laptops.
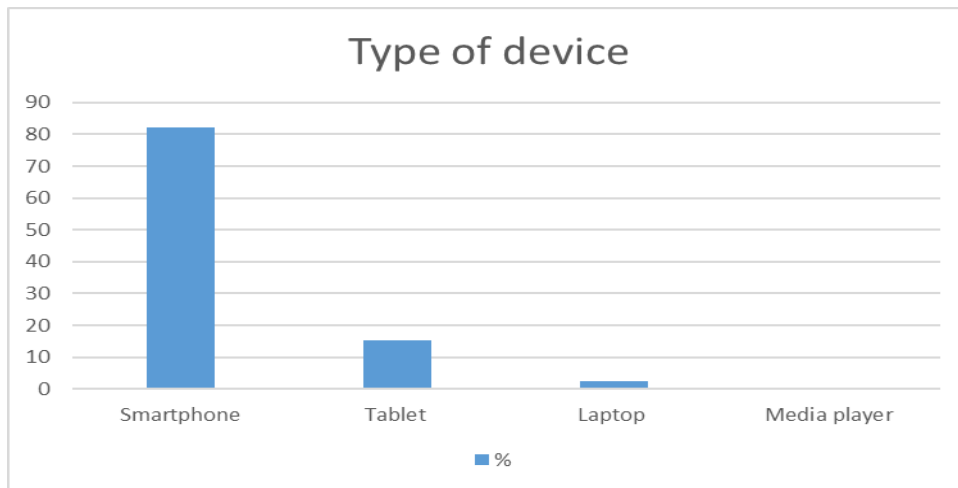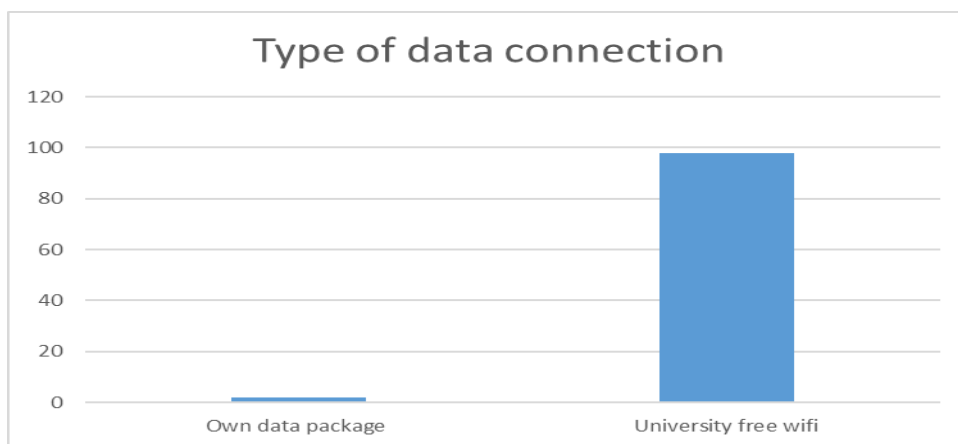
Figure 5.

Figure 6 provides data on the type of data connection used by the participants for their mobile devices.

Figure 6.

98% of the participants reported that they use the free university Wi-Fi for their data connection even if it is slow. The 2% of participants that use their own data packages were not registered students due to circumstances out of their control, such as bursaries.

10.1. Summary of findings

Based on the data, the beneficial use of mobile technology in the classroom, together with the students' need to use the technology, and the potential for future academic preparation, had a substantial influence on students' learning and engagement. It shows clearly that mobile technology has its place in the classroom and that the advantages far outweigh the disadvantages.

11. DISCUSSION

The findings of this study are in line with several other studies on the impact of mobile devices in the classroom. The 4th IR will only increase the availability of mobile devices; even some that do not even exist today. Over the last few year students have increasingly benefited from electronic technologies, podcast lectures, online courses, educational apps on mobile devices, and cooperative activities through social networking platforms (El-Hussein & Cronje, 2010; Traxler, 2007). Students enjoy the freedom technology provides them in becoming more actively engaged in the learning process. Most of the mobile learning technology devices, like tablets provide students direct access to information, course material, and real- world application of knowledge (Alsaadat, 2009; Martin, McGill, & Sudweeks , 2013). This is evident in the fact that 73% of the participants in this study indicated that they are comfortable with the use of technology in the classroom. Moreover, they all regard this access as indispensable to their learning experience. New technology often evokes feelings of both excitement and anxiety from students and faculty, and the usage of mobile teaching devices proved no different. Students indicated that the novelty of the usage of mobile teaching devices contributed positively to the learning experience. Students also recounted that the instantaneous access to information enhanced in-class discussion because they could easily search for information to share with the class. Cobcroft, Towers and Smith (2006) suggest that students benefit from "flexibility and ubiquity, that is, 'anywhere, anytime, and any device' learner engagement". The use of mobile devices in the learning process can be less effective because the small screen size of mobile devices can limit the ability to display information clearly. In that case, it will be difficult for students to see or read the information because the display screen is small, and students will be uncertain and lack understanding of the information (Hanbidge & Tin, 2020). Students also have difficulty navigating the necessary additional information via buttons. It is because the button is too small and difficult to press (Utesch et al, 2020). As discussed, instructional design and the use of technology predominantly affects student perceptions of learning (Armstrong, 2011). As students gain access to vast amounts of information, educators must provide direction. Educators must support students using mobile information to make better informed assessments and judgments when accessing information on their own. Educators must adapt the technology to specific learning goals and outcomes. Institutions of higher learning need to get policies and regulations in place to govern the use of mobile devices in the classroom. Clear "rules" on the use of mobile devices in the classroom need to be communicated to the students to minimize the distraction of other students by those that are using their mobile devices to access non-academic information such as social media during class time. The findings of this study are not dissimilar to studies reviewed during the research of this paper,

for example Manzoor, Sarwar, and Asim (2020) found that learning with the help of mobile phones makes the learners of today's technological advanced era more comfortable and thus helps them to improve their learning. The shift of electronic era to mobile services has started following the paradigm "anytime, anywhere computing."

12. CONCLUSION

The 4th Industrial Revolution ensures that new technologies are developed rapidly, and the pace is picking up each year. Guri-Rosenblit (2005) perceives that the human capacity to respond to and adapt to the pace of new technologies is meaningfully slower and limited. Therefore, educators using mobile devices in the classroom must be committed to learning how to use devices effectively in classroom. In summary, mobile information and communication technologies such as tablets, laptop computers and mobile phones will feature increasingly in the future of learning and classroom environments. Mobile devices offer benefits such as the apparently unlimited access to information and advantages for collective learning. However, these devices, if not controlled properly, can distract learners, and create frustration in the classroom. When integrated into the classroom experience sensibly and under control, educators will maximize their potential to enhance learning and minimize their interference with learning. Taking in consideration the limitations of this study, generalization is not possible, but this article is a reflection on the current situation in my classroom.

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APPENDIX

Questionnaire:

The purpose of this study is to explore and assess how mobile devices affect students' learning, participation, and engagement in the classroom.

Dear student:

Thank you for your participation in this research. Please complete the survey by answering the questions below. I am researching how mobile devices affect students' learning, participation, and engagement in the classroom.

Please circle your response to the question.

Part A

1.   What is your gender?

Male	Female

Part B

Mobile device usage:

1.   Do you own a mobile device capable of connecting to the internet?

Yes	No

2.	What mobile device to you own? Circle all that apply.

a)	None

b)	Smartphone

iPhone	Android	Windows

c)	Tablet

Kindle	Android	Windows

d) Laptop

Please Specify: _____

3.	How comfortable are you with using your device in the classroom.

Not comfortable	Fairly comfortable	Very comfortable

4.	Please indicate what is your perception on the use of mobile devices in the classroom have on your level of engagement, participation, and learning.

	Perception	Agree	Uncertain	Disagree
1	Other students' use of mobile devices distracts me in class			
2	I play games on my mobile devices in class			
3	I enjoy using mobile devices for in-class activities			
4	Use of mobile devices in the classroom facilitated my collaboration with other students			
5	I concentrate better on my studies when using mobile devices			
6	I access social media on my mobile device in class			

5.	Please indicate what you use your device for during class, you can mark more than one.

Usage	
Blackboard (Learning management system)	
Other e-learning tools	
Internet browsing	
Listen to music	
Watch YouTube	
Search for information	
Send and read emails	
Using Facebook	
Using Instagram	
Using WhatsApp / We chat	

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6.   Please indicate what type of device are you using during class.

Device	
Smartphone	
Tablet	
Laptop	
Media player	

7.   Indicate the type of data connection you are using in class.

Connection type	
Own data package	
University free Wi-Fi	

8.   Describe briefly possible ways that you would like to see the use of devices integrated into the classroom.

Activity	
To access current information during class	
To access alternative online textbooks	
To collaborate with other students during class for group work	
To record lectures	
To submit homework	

Any other suggestion:

……………………………………………………………………………………………
…………………………………………………………………………………………..

9. Please write a short comment on any idees or thoughts you may have regarding the use of electronic devices in the classroom.

THANK YOU
FOR SPENDING TIME
ON ASSISTING ME
WITH THIS RESEARCH

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Biographical sketch: Gerhard is a lecturer specializing in Mechanical Technology training for student teachers. He completed his MEd degree focusing on the emotional intelligence of the Student Teachers studying for their Teacher's degree at the Central University of Technology in South Africa. His doctoral research is focusing on using digital devices in the classroom with special focus on using preloaded e-textbooks. He come into the Higher Education System late as het spend more than 25 years in the industry before venturing into the education sector. His passion is bringing the industry to the classroom to introduce the student to more than just theoretical work.