

# STUDENTS' PERCEPTIONS TOWARDS INSTRUCTOR-DEVELOPED SCREENCASTS AS A STAND-ALONE METHOD OF INSTRUCTION ON WHATSAPP IN AN INTRODUCTORY STATISTICS COURSE DURING COVID-19

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## ABSTRACT

E-learning and access to internet facilities remain a problem for many students in South Africa. The purpose of this article is to assess students' perceptions of the use of WhatsApp as an online learning technology together with instructor-developed screencasts as a stand-alone method of instruction in an introductory statistics course during the COVID-19 pandemic at a South African university. The responses to an open-ended questionnaire showed that students preferred WhatsApp over the university's student learning platform. Although it is advocated to use screencasts to supplement traditional lectures, the findings of this research revealed that instructor-developed screencasts have the potential to be used as a stand-alone method of instruction for the teaching and learning of introductory statistics. Participants' responses also revealed that, apart from the electronic connection they had on WhatsApp, they valued the emotional connection as well. The sharing, support, love, as well as cooperation among the lecturer and students emphasised the importance of *ubuntu* in educational settings. Furthermore, the results revealed that the attitude and support of a lecturer play a crucial role in providing an online atmosphere where students feel safe and comfortable, especially during the pandemic period.

**Keywords:** WhatsApp, instructor-developed screencasts, introductory statistics course, COVID-19 lockdown, South African university

## INTRODUCTION

COVID-19 has turned the world upside down and altered the lives of millions of people all over the globe. Every area of our lives has been impacted, from how we live and interact with each other, to how we work, communicate and learn. During the COVID-19 pandemic, online learning has emerged as the most viable option for continuing the learning process in higher education around the world. However, online learning can only be successful "if it focuses on aspects of the presentation of learning content and learning tools, which are the most critical

factors that affect student academic achievement” (Wargadinata et al. 2020, 146).

Mobile learning is one part of e-learning and utilises mobile learning technologies such as smartphones, laptops, tablets and the internet, which allow students to learn and access learning resources at anytime from anywhere. Due to the COVID-19 lockdown restrictions and limited movement worldwide, students were forced to study from home and communicate with the outside world mainly with their mobile devices. This made mobile learning an attractive choice to use during the 2020 academic year due to its accessibility and affordability. In fact, recent literature indicates that students in South Africa are addicted to their mobile devices (Mavuso, Jere, and Matsebula 2020). Mobile learning allows instructors to provide learners with resources in an accessible format, and ensures effective communication by using technologies to deliver messages, videos, notes, and subject content. Although numerous applications exist in mobile learning, WhatsApp offers a competitive advantage over other social network platforms due to its cost-effectiveness and easy-to-use features. Since e-learning and access to internet facilities are not accessible for many students in South Africa, the utilisation of WhatsApp as an e-learning tool may be one way to mitigate this problem. Ranked as the top messenger application in the world, 98 per cent of active social media users in South Africa access WhatsApp via their mobile devices (Kemp 2020). In the prevailing situation of the COVID-19 pandemic, WhatsApp can enrich the learning experience, as students can contact their lecturers via WhatsApp regardless of physical distance, while instructors can make contact with learners at their own convenience. Although WhatsApp has been favoured by many educators and students during the COVID-19 pandemic (Wargadinata et al. 2020; Susilawati and Supriyatno 2020), little is known about the teaching and learning of an introductory statistics course on WhatsApp during the 2020 lockdown academic year. Technically it seems challenging to create rich statistics course content in a poor-data context on WhatsApp. But is it?

Furthermore, how does one maintain students’ interest without face-to-face interaction? The implementation of screencasts in an educational context enable educators to provide content outside the classroom by using a medium which is almost second nature to students. Tabuenca, Kalz, and Lohr (2018, 3) state that “video lectures represent one of the key formats to deliver educational content” in Massive Open Online Courses (MOOCs). This real-time format serves as a platform where problems can be explained while also offering interpretive-based conceptual understanding in an engaging learning format. Not only has the use of screencasts in educational contexts and its applications to online learning been well recognised by educators over the past few years, but research has shown that the use of screencasts is particularly popular in mathematics and statistics courses as a supplementary tool to support or

complement face-to-face learning (Khan, Loch, and McDonald 2010; Jordan et al. 2012; Ahmad et al. 2013; Dunn, McDonald, and Loch 2015). However, little is known about the effective use of screencasts as a stand-alone method of instruction in an introductory statistics course during the COVID-19 lockdown period.

Although the focus of this article is on the use of WhatsApp and instructor-developed screencasts, *ubuntu* should be at the centre of our response to the COVID-19 pandemic. Instructors should respect and care for all their learners irrespective of their background or circumstances (Mahaye 2018). Furthermore, it is our obligation to encourage learners to work cooperatively through sharing and engaging with others. As Mahaye (2018, 17 of 32) purports “collectivism associated with harmony and cooperation means working for the benefit of the whole, based on a long-term vision, rather than the benefit of constantly changing individuals”. By applying the core values of *ubuntu* we develop the human character of our students. These values are rooted in love, and include compassion, humanness, sharing, caring and respect for each other.

Although strides have been made with regard to the use of WhatsApp and screencasts that supplement face-to-face lectures, there is a gap in research when it comes to determining the perception of students towards WhatsApp as an online learning technology, together with instructor-developed screencasts as a stand-alone method of instruction in the teaching and learning of an introductory statistics course at a South African university during the COVID-19 pandemic lockdown period. To shed light on the problem statement, the following research questions were set:

- Q1: How do students perceive WhatsApp as an online learning technology in statistics?
- Q2: How do students perceive the instructor-developed screencasts for explaining statistical concepts?

## **SIGNIFICANCE OF THE STUDY**

The significance of this study is threefold. Firstly, the study seeks to add to the body of literature by reflecting on students’ perceptions on the utilisation of WhatsApp, together with instructor-developed screencasts, in a fully online statistics course during the COVID-19 pandemic period at a South African university. The collaborative environment and opportunity to communicate with the lecturer and fellow classmates on WhatsApp may enrich the learning experience of students by offering an engaging mobile learning environment conducive to improve students’ understanding of an introductory statistics course. The instructor-developed screencasts allow students to rewind, pause and play videos and to practice at their own pace, which in turn may

facilitate a better understanding of certain statistical concepts, and as a result, a better understanding of statistics. With the increased utilisation of online learning modalities during COVID-19, it is imperative to have an awareness about how students feel about this mode of learning, so that educators can ultimately design the form of e-learning that students would want in the future. Secondly, the study can provide insights for academics who are also interested in engaging in online statistics courses during the 2021 academic year, as well as the future. The findings of this research should be of wide interest and can offer some broad guidelines to other academics at higher education institutions in South Africa on how to make the most of e-learning so that students can benefit from and enjoy it. The challenges posed by e-learning during the lockdown period affect education institutions worldwide. As such, an international audience may also benefit from the findings of this research.

Thirdly, the study advances teaching and learning in higher education as it considers the importance of love, higher pedagogy, as well as *ubuntu* with the emphasis on human connections such as within a WhatsApp group, instead of an isolated online activity. Love is a crucial building block in rigorous academic environments, and its importance in educational settings resonates with both teachers and students. Pedagogical love contributes to students' experiences by providing them with positive learning experiences. Through the WhatsApp group, students are provided with an opportunity to hear one another's voices, recognise one another's presence, and generate excitement which is deeply affected by our interest in one another as a human being. Ubuntu is the ability to relate to each other. This feature is taken on when we interact with others, show empathy, and putting in efforts into building relationship. In a quest to rediscover the *ubuntu* paradigm in education, the intention of this article is to enrich students' online experience by utilising a WhatsApp group and by applying the philosophy of human kindness, as well as meaning-making within a collective approach as opposed to an individualistic one. By articulating solidarity and togetherness, *ubuntu* may fundamentally alter the design of online courses. According to Waghid (2020, 299) "practices such as social responsibility, deliberative engagement, and an attentiveness to others and otherness seem to be most salient in enacting a reconsidered view of African higher education". Furthermore, a blend of the valuable attributes of *ubuntu* education could help to strengthen the long-standing consequences of the colonial legacy of the education system experienced in Africa and provide a suitable framework for cultivating the idea of an integrated, supportive and emancipatory learning environment for each and every student. In fact, Piper (2016, 101) argues that "applying *ubuntu* in educational development would result in a field that is more humble, self-critical, diverse and inclusive, and ultimately more focused on serving the purposes of the poor in Global South".

The results of this study confirm the need to include alternative paradigms of education that are less individualistic and Eurocentric than what has been the standard over the past few decades and are still prevalent in numerous education systems (Oviawe 2016). The alternative paradigm employed in this study showed how pedagogical love and the concept of ubuntu are inseparable and how both makes a significant contribution to higher education in Africa.

## **THEORETICAL FRAMEWORK**

Connectivism (Siemens 2004) and the cognitive theory of multimedia learning (Mayer 2009; Clark and Mayer 2016) offer a valuable lens for a deeper understanding of teaching and learning through digital technologies. Connectivism provides a learning model that recognises tectonic changes in society where learning is no longer an internal, individualistic behaviour. Instead, connectivism explains how internet technologies have created new opportunities for people to learn and share information among themselves and across the World Wide Web. These technologies include online chat groups, email, web browsers, YouTube, social networks, and any other platform that allow users to learn and exchange information with others (Siemens 2005; Downes 2010). Applying the connectivism theory to this study suggests that learners must be supported with a technology-rich environment, such as WhatsApp, that is well equipped with technical tools that facilitate teaching and learning in order to make learning exciting. In order to support student learning and sharing of information amongst one another the role of the instructor is to guide students and answer key questions asked by students (Siemens 2005; Downes 2010). A connected community around this shared information often results. Picciano (2017, 175) is of the view that “connectivism is particularly appropriate for courses with very high enrolment”.

The overarching principle of multimedia learning is that we learn more effectively from pictures and spoken words, than from words alone (Mayer 2009). Effective learning with multimedia could be facilitated by producing screencasts, which could be used as tools to demonstrate different ways of problem solving and to teach higher-order conceptual knowledge (Lloyd and Robertson 2012). Furthermore, the principle of personalisation in multimedia learning suggests that learners can learn better from multimedia, such as images, when words are in conversational rather than formal style, particularly when the presenter talks to a personalised audience such as a group of students. As such, it makes sense for teachers to create their own screencasts instead of looking for thousands of instructional screencast videos on the internet.

## **LITERATURE REVIEW**

In the changing landscape of higher education during the COVID-19 lockdown period, where there was no choice but to engage in online teaching and learning activities, it is important to be aware of the scope and implications of such rapid and unforeseen transformation on student learning. In this article, the focus is on the use of WhatsApp and screencasts in online statistics education.

## **WhatsApp**

The COVID-19 pandemic has disturbed higher education all over the world. Universities and schools in South Africa had to react to the challenges posed by the COVID-19 pandemic by using innovative ways to ensure that students successfully complete their studies. As such, most universities started to invest in online learning. Literature shows promising results and indicates that mobile learning is especially helpful in restoring the study gap during the COVID-19 pandemic (Biswas, Roy, and Roy 2020). By reflecting on the role that mobile learning, as a remote teaching and learning strategy, plays during the pandemic, Naciri et al. (2020) make it clear that mobile learning is an unavoidable alternative during the COVID-19 pandemic.

WhatsApp is a popular application in mobile learning. It is a free messenger application that works across multiple platforms such as iPhone and Android phones. Wargadinata et al. (2020, 150) are of the view that WhatsApp is a familiar social media app that is easy to use and does not require a large data quota package. With the support of data services, the WhatsApp application offers consumers many enticing features that can be used to connect with others, such as “text messaging, group chat, voice and video calls, photos and videos, document sharing, and links to web address” (Wijaya 2018, 47). This is confirmed by Susilawati and Supriyatno (2020). What makes this application even more appealing is that much information can be obtained in real time, and digital information sharing is both convenient and instantaneous (Fogg 2010).

Apart from being an excellent communication tool, WhatsApp messenger also has the potential to be used as a learning tool to support the learning process (Susilawati and Supriyatno 2020, 853). In an educational context, WhatsApp provides numerous benefits, such as “direct access to lots of online resources, more focus on students’ creativity, autonomy, and responsibility on one’s own learning” (Gon and Rawekar 2017, 20). The effectiveness of WhatsApp as an online learning technology has been well documented in the past few years, for example, how it supports blended courses (Barhoumi 2015), how it serves as a convenient tool for teaching and learning activities (Gon and Rawekar 2017), as well as how it fosters connectedness in students’ online experience (Stone and Logan 2018). According to Stone and Logan (2018, 52), “there may be merit in lecturers and learning technologists that encourage

the formation of social media groups, pointing out the benefits for building connectedness and in turn, a learning community”. As Barhoumi (2015, 223) purports: “WhatsApp Instant Messaging promotes online collaboration and cooperation between students who study online”. Furthermore, research shows that WhatsApp groups contributed significantly in helping students to communicate actively while encouraging meaningful learning among users (Jain and Rahman 2016), and particularly during the COVID-19 pandemic (Wargadinata et al. 2020; Susilawati and Supriatno 2020). This makes sense, as students in a WhatsApp group can easily share “learning objects through comments, texting and messaging” (Barhoumi 2015, 223). Learning could take place optimally because lecturers and students are able to communicate with one another and share voice notes, videos, word documents, JPGs, PowerPoint files, as well as other links to resources (Wargadinata et al. 2020, 141).

### **Screencasting**

Dunn et al. (2015, 522) indicate that students in introductory statistics courses have insufficient exposure or little understanding of quantitative concepts in general, and particularly towards statistics as a teaching and learning discipline. As such, one can understand that these students have no intrinsic motivation for studying statistics, and as a result often experience statistics anxiety (Tishkovskaya and Lancaster 2012). To help students conquer their statistical anxieties, face-to-face assistance is often provided by tutors in a designated support space during defined hours. However, as a result of the COVID-19 pandemic, this assistance is not possible and other flexible solutions needed to be considered. One solution in this spirit is to create short screencasts (screen video with audio commentaries) for students to view online.

Screencasting is defined as “capturing what you do on the computer screen with synched audio commentary” (Lloyd and Robertson 2012, 68). As such, screencasts have the potential to serve as a means of delivering lectures, particularly online lectures before and after face-to-face classes (Kilickaya 2016). Khan et al. (2010, 334) emphasise that “it is important in the mathematical sciences to write by hand when explaining the pathway to the solution of a problem”. With recent advancements in technology, a tablet PC or a smartphone can become a tool that removes the need for the whiteboard when writing can be done on a tablet screen or smartphone. In fact, research confirms that students preferred handwritten explanations rather than typeset, as it relates to feeling, more engagement, and spontaneity (Jordan et al. 2012).

In many large undergraduate statistics classrooms, students find it difficult to concentrate on both the content of concepts as well as note-taking throughout a long lecture. As such, students often divide their attention and either try to understand the work by not taking notes, or writing down notes without listening to the lecturer explaining the work (Yoon and Sneddon

2011). Hoepner, Hemmerich and Sterling-Orth (2016, 103) point out that “the implementation of screencasts in an educational context enable educators to provide content outside the classroom and sets the stage for innovative pedagogy that encourages students to be more interactive with content during class time”. This real-time format serves as a platform where problems can be explained, while also offering interpretive-based conceptual understanding in an engaging learning format. Kilickaya (2016, 81) states that “short instructional materials with narration have been found to better promote learning, especially for learners with low prior knowledge of course content”. As screencasts can be reviewed numerous times, it allows for concept clarification and reinforcement, while also encouraging meaningful learning (Lloyd and Robertson 2012, 68).

The benefits of screencasting in educational contexts show promising results, while its potential applications to online learning have been recognised by educators, especially in mathematics (Ahmad et al. 2013; Jordan et al. 2012). Over the past few years, several studies explored the effectiveness of screencasts as educational support on the teaching and learning of statistics-related subjects. Dunn et al. (2015) assessed the effect of screencast tutorials on learning outcomes, which include statistical knowledge, application and interpretation. The results of their study demonstrated that when compared to traditional instructional techniques, screencast tutorials are an efficient as well as effective tool to enhance student learning, particularly for higher order conceptual statistical knowledge (Lloyd and Robertson 2012, 67). Suanpang, Petocz and Kalceff (2004, 9) investigated students’ attitudes in Business Statistics by comparing online and traditional methods at a university in Thailand. The findings of their research showed highly significant differences in attitudes towards statistics between students who study online and those that follow a traditional approach. Khan et al. (2010, 333) investigated the benefits and challenges of lecture screencasts that were provided to on-campus students as well as distance students of an introductory statistics course at the University of Southern Queensland. The anecdotal evidence of their study indicated that after technical problems have been resolved, the recorded lectures have been well received by students (Khan et al. 2010, 333). Dunn et al. (2015) used a screencast app to complement lectures in a statistics class at an Australian university. Analysis of their data showed that students are actively involved with the StatsCasts which tend to be an important component of their study and revision strategy.

Hoepner et al. (2016, 101) argue that “in order to evaluate advantages and limitations of screencasting tools, it is necessary to understand the potential implementation”, which is related to the pedagogical approach being used. As instructors, we need to consider crucial pedagogical factors as we are responsible for determining the ideal duration, content, and delivery platform

of subject content. One of the principles of multimedia learning is segmenting, as it allows learners to see the causal relationship between one step and the next. In other words, screencasts (video content) are presented in segments rather than as a continuous unit (Spencer and Victor 2017). Stahl et al. (2010) purport that learning material should be presented in bite-sized chunks which are succinct and precise when it is provided via mobile phone. To foster implementation and refinement of screencasted productions, concepts that can be taught in three to 10 minutes should be isolated (Hoepner et al. 2016, 101).

The section above provided a clear understanding of how literature critically relates to the research topic at hand, and has shown the benefits of screencasting tools, WhatsApp in mobile technologies as a form of e-learning, and how the use of these tools make sense in an introductory statistics course.

## **METHODOLOGY**

### **Background to the study**

When lockdown started at the end of March 2020 in South Africa, the researcher created a WhatsApp group which both groups of statistics students have joined. The lecturer used two apps to make “lecture recordings” with the use of her mobile smartphone. The first app was Screenrecorder™. This easy-to-use free tool is a screen recorder that records and captures your mobile screen in high-quality HD video formats with or without the use of a front camera (AppSmartz 2019). The researcher used her Android mobile phone and made use of the whiteboard feature of this app to make handwritten notes on the mobile screen while recording and creating tutorials to explain more difficult statistical concepts. The whiteboard videos were more or less 10 minutes each, and focused only on one learning outcome at a time with regard to a certain chapter in the textbook. Each video was saved under the name of the statistical topic that was introduced to students. The second app that was used is AZ Screen Recorder (Hecorat 2021). The researcher used this stable, high-quality app with internal sound to record short videos from the prescribed statistics textbook. The researcher used her smartphone’s camera function to record important statistical concepts from the textbook with complete and clear voice recorded explanations. Each video was two minutes long and only focused on one example from the textbook at a time. The videos were saved with the name of the example from the textbook, so that students could refer back to them when needed. For each chapter that was done in the textbook, the researcher posted these recordings and relevant pictures from the textbook on both the WhatsApp group, while tests were deployed on the student learning portal, eThuto. The researcher used the multiple-choice test feature on the platform, which

automatically marked students' tests once they completed the tests online. Students had automatic access to this platform once they were registered for this subject. The university provided students with data bundles, as many students came from poor societies and could not afford data to access the internet for online learning. As some students were situated in remote areas, or ran out of their data bundles in 30 days, the researcher allowed them to submit their written tests to her on WhatsApp or via e-mail. The majority of students successfully submitted their tests online. The researcher communicated with students on a daily basis, and had open discussions on WhatsApp about the new content in the introductory statistics course. Many students participated on the WhatsApp group and interacted with the lecturer and fellow classmates when new statistical concepts were introduced and explained. The second semester in this statistics subject started at the end of September 2020 and is still continuing online.

### **Research design**

The aim of the research was to determine students' perceptions towards WhatsApp and instructor-developed screencasts as online learning technologies in an introductory statistics course at a higher education institution in South Africa. In order to respond to the proposed research questions, a qualitative research design was used to gain in-depth insights on students' perceptions. Windschitl (1998) urges researchers to use qualitative analysis approaches for exploring, documenting and describing web-based learning and teaching developments. Qualitative data was obtained by making use of open-ended questions to evaluate how students perceived the use of WhatsApp and instructor-developed screencasts to deliver the introductory statistics content.

### **Population**

All 220 students who enrolled for the introductory statistics course (Quantitative Techniques) at the university were invited to take part in the study. Of the total population of 220 registered students, 113 participated in the study.

The researcher did not make use of a random sample of participants, but rather employed a non-probability sampling strategy. For this study, a convenient sampling approach was used, as participants were already available and formed part of the Quantitative Techniques classes (McMillan and Schumacher 2006, 125). This introductory statistics course is compulsory for all students who enrol for the Diploma in Human Resources and the Diploma in Marketing. Both groups of students were instructed by the same lecturer, shared the same textbook, slides, videos and learning material and wrote the same tests. Both groups were also integrated on the same WhatsApp group as well as the same digital online learning platform of the university.

## **Data collection**

In order to gauge students' perceptions towards WhatsApp as an online learning technology and instructor-developed screencast in an introductory statistics course during the COVID-19 period, the researcher compiled an open-ended questionnaire. The data collection measure was employed by the researcher at the end of the first semester course during September of the 2020 academic year. The two open-ended questions were posted on the statistics WhatsApp group. Students were informed about the purpose of the survey, and that their feedback would be valuable. Students sent their responses privately to the lecturer on WhatsApp. Permission and ethical clearance for this research study was obtained from the Faculty Research Ethics Committee at the university before the data collection began. The degree to which the findings of the study are generalisable may be a concern with regards to the external validity of this research (Saunders, Lewis, and Thornhill 2003, 102). Since this research has been conducted at a single university and no randomisation has been used, the findings may not be generalisable to all students in introductory statistics courses at other universities.

## **Instrument**

In order to answer the research questions, the researcher considered it necessary to make use of open-ended questions, as these have the ability to promote detailed and meaningful responses from students' own experiences and feelings towards WhatsApp and the instructor-developed screencasts as online learning technologies in the introductory statistical course at the university. According to Foddy (1993, 127), "open-ended questions allow the respondent to express an opinion without being influenced by the researcher". Free-form written responses show how participants think, and more can be gained from their own words and from reading their thoughts. This also provided the researcher with a clearer picture of how the online delivery of introductory statistics could be improved through mobile technology, if applicable. To avoid bias in responses among students, the researcher used simple language and the questions were straight forward and concise. All questions were also reviewed by a research expert. The questions were:

- Q1: How do students perceive WhatsApp as an online learning technology in statistics?
- Q2: How do students perceive the instructor-developed screencasts for explaining statistical concepts?

## **DATA ANALYSIS AND INTERPRETATION**

To answer the open-ended research questions and analyse students' responses, the researcher made use of thematic analysis. Braun and Clarke (2012, 57) argue that thematic analysis "is a method for systematically identifying, organising, and offering insights into patterns of meaning (themes) across a data set". To perform the data analysis in this research, the six-phase guide of Braun and Clark (2006) was used as a framework. After reading all the transcripts first, the researcher organised the answers in a structured manner by coding the data and reducing it to small chunks of significance. The researcher then grouped the codes into broader themes that appeared to say something about the research questions. The findings were reported in the final phase after the themes were reviewed and defined. In order to ensure anonymity, the researcher used S1 for the first student, S2 for the second student, and so on. The researcher used students' own verbatim information, and as such it may contain spelling or grammatical errors.

In the following section, the researcher discusses the data analysis as well as its interpretation.

## **RESULTS AND DISCUSSION**

The findings related to students' perceptions towards the use of WhatsApp and instructor-developed screencasts as online learning technologies in the introductory statistics course are presented below. Suggestions for improvement from students are also discussed.

### **Students' perspectives towards the use of WhatsApp as an online learning technology**

Four broad themes were identified from students' responses, which include the preference of WhatsApp over eThuto due to students having limited data or internet connectivity challenges, the convenience of WhatsApp, collaboration on the WhatsApp group, as well as non-work related group chats.

A common theme that emerged from students' responses was that they preferred WhatsApp over the student portal eThuto because of *limited data or connectivity challenges* during the lockdown period. Responses to confirm this finding include the following: "Mam I am struggling to access my ethuto can you please send the videos in our WhatsApp group" (S1); "I'm struggling to submit via ethuto" (S2); "Some of us are on WhatsApp data I can't access every information posted on ethuto" (S3); "Things are very hectic for some of us as students. Couldn't submit one of my assignments today due to complications we are facing as students with this data issue" (S4); and "It is not that we don't want to write, the problem is data" (S5). Another student said: "Some students come from very poor backgrounds. We discover more and more every day that there are students that come from very heart-breaking

backgrounds and environments which have an influence on their new way of learning through the stats WhatsApp group” (S6). Although a large number of students have laptops and smartphones, many experience difficulties in maintaining access to effective technology. Many students were staying in off-campus apartments or remote areas without reliable internet connectivity. Others ran out of data and could not afford to add minutes. This problem echoes the findings of Gonzales, McCrory and Lynch (2020), as well as Mpungose (2020), who articulate the digital divide as a hindrance for disadvantaged students to realise the full potential of e-learning.

The second theme that emerged from students’ responses, is the *convenience* of WhatsApp. Many students indicated that they prefer WhatsApp over the student portal of the university, namely eThuto. For example, some of the things that students mentioned are the following: “In my perspective I prefer WhatsApp mam coz in there we are able to raise our concerns and you are here with us 24 hours and you are able to assist at any time. Face to face we get tired and we are in a hurry to finish and go” (S7), and “I love the WhatsApp group more than ethuto. It is more convenient” (S8).

Another theme that emerged from students’ responses is the shared *collaboration* that the WhatsApp group offered them. Some of the responses included that “the stats WhatsApp group is more active than before the lockdown which lead to very interesting topics at times” (S9); “we learn from each other and we are constantly in contact with our lecturer” (S10); “we actually became a family through WhatsApp and for me that is priceless” (S11); and “The statistics WhatsApp group have been nothing but supportive during this hard time” (S12). This finding echoes the importance of online collaboration and cooperation among students who make use of WhatsApp to study online (Barhouni 2015). Students learn from each other by hearing various explanations that they might not have thought about themselves. Collaborative learning techniques are also a powerful way to reinforce concepts and facilitate understanding among students, since they reflect on the resources and expertise of one another. Although it was not part of the research questions, one student posted the following on the statistics WhatsApp group: “Guys let me just spread a little positivity in the group we all conquer the upcoming tests, we will achieve great marks in all our modules, we will not give up no matter what the circumstances are because we know where we get our strength from, we did it once we can do it again. Lastly we will achieve success this semester. If you believe it you can achieve it” (S13). This message clearly shows how students supported and motivated each other on the statistics group. This confirms the contention of Stone and Logan (2018) that there may be merit in encouraging the formation of social media groups for the benefit of building connectedness among students.

Another theme that emerged from students' responses is that students did not stick to *work-related chats* on the WhatsApp group. Remarks such as the following echo the findings of Cetinkaya (2017) about redundant posts on a WhatsApp group: "many times students don't talk about issues that is work related and make jokes all day and it can become very annoying at times" (S14); and "Some students need to stop sending unnecessary pictures and gifs on the group. Sometimes I think it is work related so I download it just to find out it is not. It has an effect on my data which is very expensive and my phone gallery space" (S15).

### **Students' perspectives towards the instructor-developed screencasts**

Two broad themes emerged from students' responses related to the instructor-developed screencasts, which included the *ease of use of videos* compared to a traditional class setting, as well as the *rewind/pause and play features*.

A recurrent theme that emerged from students' responses was how the instructor-developed screencasts were particularly helpful for understanding statistical concepts. Responses like "I am happy I must say. I benefited from the videos please don't stop making them. Some of us can't make it to campus, but with the help of those videos I passed" (S16); "For me the videos were really good cause you explained them very well and you go through everything at a slow pace" (S17); "I understand my work more with the videos that mam send to us" (S18); and "the videos helped a lot" (S19). One student said: "I didn't think I was going to enjoy this class because I'm not a maths person. But because of your videos it made it easy to understand. As for me I understood the content much better than when I was in class without any disturbances" (S20). One student even said: "I see what you did there ... that's 24 years of experience" (S21). This comment confirms the contention of Jordan et al. (2012) that students like short, focused screencasts that are recorded by an expert.

Another theme that emerged from students' responses was the ability to *rewind/pause and play videos* again. Some responses that support this finding included the following: "In class when you explained something and we wrote down how you got to the final answer, when I got home sometimes I forgot how you did some calculations. With the videos I can easily go back to see how you got your answers" (S22); "The videos were really helpful one could listen and watch the video as many times as you wish until you understand" (S23); and "Unlike class where students are afraid to ask the lecturer to repeat the explanation over and over again, it becomes easier to work through the examples when you can pause, play and rewind as much as you like" (S24). This confirms the contention of Lloyd and Robertson (2012) that screencast tutorials are an effective and efficient tool that can enhance student learning for higher order conceptual statistical knowledge.

### **Students' recommendations with regard to the online learning of statistics**

A few perspectives were expressed with regard to what students think can be done to make online learning better. One aspect that students mentioned was the *instructor-developed screencasts* that the statistics lecturer used to deliver her online lectures on WhatsApp. This finding is supported by responses such as: "I just wish the other lecturers will make videos like you, so that we can refer back when something does not add up" (S25); and "Mam can't you show the other lecturers how you make these videos?" (S26). It is clear that students found the instructor-developed screencast videos helpful, and would prefer to have such screencasts made for all their subjects.

The second theme that emerged from the responses of students is the *support of the lecturer* in the online teaching and learning process. Although students benefited from the WhatsApp group and instructional screencast videos, many students indicated how grateful they are for the *emotional support* their lecturer gave them, for example, one student stated that "Nobody at this point has put themselves in the position of students like you have" (S27); "You make sure we are never behind with the work. I wish some lecturers could take notes from you mam you make everything easy for us and give us hope when we feel like giving up" (S28); "You have been with us all the way since this corona issue, and that is why we love you (S29)", and "We thank you for giving us this platform, we are able to laugh together even if it's through social media but it's better than nothing at all ... You are a blessing" (S30). One student said: "Not in my entire life I've met an educator or should I say a lecturer who likes to see her students pass by all means going the extra mile like this"; "Our mother away from home" (S31); and "I have no words to describe what you mean to us, but we really do appreciate you mam" (S32). Responses such as these confirm the contention of Kilickaya (2016, 74) that a teacher's attitude towards students "play a crucial role in a teaching and learning setting as they are considered a precondition for success and an anxiety-free atmosphere in the classroom".

The first research question was: How do students perceive WhatsApp as an online learning technology in statistics?

Based on the qualitative results of the study, the following conclusions can be drawn. Although data and Internet connectivity challenges experienced by some students remain a challenge, the WhatsApp platform was favoured compared to the university's online learning platform. Students highlighted the constant availability, immediate feedback of the lecturer, as well as the collaborative environment and opportunity to communicate with fellow classmates on WhatsApp as features that made the engaging mobile learning environment conducive to improve their understanding of difficult concepts in the introductory statistics course. Although

some students were not happy about the random talk on the WhatsApp group, the researcher noted that students shared important links, notes, test dates and reminders of other subjects at the university on the statistics WhatsApp group. From what emerged on the group chat, it seems that some students were not even aware of some assignments' due dates or tests, and were glad to be notified on the statistics WhatsApp group. The WhatsApp group not only served as a teaching and learning platform, but also as a platform where students could have light-hearted conversations with each other, connect emotionally, remind one another about upcoming tests, and support each other.

The second research question of the study was: How do students perceive the instructor-developed screencasts for explaining statistical concepts?

Based on the qualitative results of the study, the following conclusions can be drawn: In particular, the whiteboard function on the Screen Recorder app has improved the content and skills specific to the learning objectives of statistical learning. Students also pointed out that the rewind, pause and play functions of the videos enabled them to practice at their own pace, facilitating a more thorough understanding of certain aspects of the introductory statistics course. It is evident from the comments above, that students notably benefited from the instructor-developed screencasts, and reported a deeper understanding of statistics. Although numerous research studies suggest the use of screencasts to supplement traditional face-to-face instruction, it seems that students benefited from this stand-alone method of teaching on WhatsApp.

Apart from the technological aspects, the finding of students' comments showed that students need emotional support from each other, as well as their lecturer. The sharing, support, love, as well as cooperation among the lecturer and students emphasised the importance of *ubuntu* in educational settings. To following guidelines may provide such opportunities:

- Have random chats with students on the WhatsApp group that are not subject related. Students want to interact with lecturers in an informal manner as fellow human beings with whom they can have light-hearted and everyday conversations.
- Assist students as much as possible. Sometimes students struggle with small technical difficulties or just need a shoulder to cry on, especially during the COVID-19 academic year. Students look up to their lecturers, and if lecturers do not display a positive attitude during these challenging times, students might become negative, which will impact negatively on their learning.
- Encourage students to ask questions if they do not understand. Some students are afraid

to ask questions on a WhatsApp group, so they need to be informed that they are welcome to send a private message to the lecturer if they need further assistance.

## **CONCLUSION**

The sudden reform in education from traditional face-to-face learning to online learning had a massive impact on education institutions worldwide due to the COVID-19 pandemic. The aim of this research was to provide insights into how students perceived WhatsApp and instructor-developed screencasts as online learning technologies utilised in an introductory statistics course at a South African university. Connectivism offers insight into the learning skills and tasks required for learners to thrive in a digital age, while the cognitive theory of multimedia learning suggests that we learn more effectively from pictures and spoken words, than from words alone. Effective learning with multimedia was facilitated in this study by producing screencasts which were used as a tool to demonstrate different ways of problem solving, and to teach higher-order conceptual knowledge in an introductory statistics course. Although research suggests that screencasts are beneficial to support face-to-face instruction, the findings of the open-ended questionnaire revealed that students shared positive perspectives about the use of WhatsApp as well as the instructor-developed screencasts that were employed on this platform as a stand-alone method of instruction in the introductory statistics subject. This research provided evidence that it is indeed possible to deliver high-quality subject content in a low data-cost context, and that students benefited from it.

The findings of the study clearly indicate that, although the technology know-how is necessary to connect with our students virtually, it is not enough to sufficiently continue the teaching and learning endeavour. Beyond the electronic connection students had on this platform, they connected emotionally as well. Students' responses made it clear that the attitude and support of a lecturer plays a crucial role for providing an online atmosphere where students feel safe and comfortable – especially during the 2020 academic year which was filled with anxiety and uncertainty due to the COVID-19 pandemic.

The findings of this research shed some light on potential enhancement for online learning. Training in screencasts can be provided to assist other lecturers to make their own screencasts. Lecturers are encouraged to not only focus on the technology aspects and what works best to deliver content online during challenging times such as the COVID-19 pandemic, but also to engage with students in an informal way, to laugh and engage with them as fellow human beings. By providing our students not only with the best online technology, but also supporting them emotionally, students will feel that they are guided, supported, comforted and encouraged to continue online learning during the pandemic, despite all the challenges they have to face.

Although there are specific contributions to the study, there are certain limitations. The study used a relatively small sample size from the student population. Subsequent evaluation studies are recommended for larger sample sizes as well as from various disciplines. The results of this research have clear significance to an international audience with broad recommendations on the adoption of WhatsApp as an online learning technology, instructor-developed screencasts, as well as emotional support from instructors to create a feasible online environment in which students can study effortlessly online.

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