# Readiness of Students for Multi-Modal Emergency Remote Teaching at A Selected South African Higher Education Institution

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**Abstract**

The closures of Higher Education Institutions (HEIs) due to the Covid-19 pandemic meant that face to face classes had to be put on hold. However, the growth in information and communication technologies (ICT) made it possible for HEIs to continue with their core activities remotely, primarily using learning management systems (LMSs). The overuse of LMS at the selected HEI resulted in the former's collapse. The consequence was that management of the institution advised lecturers to use multi-modal emergency remote teaching (ERT) to save the academic year. Lecturers adopted a variety of platforms and approaches, largely depending on their preferences. This study identified the ICT platforms and approaches used by lecturers during remote teaching as well as estimating the readiness of students for emergency remote learning. Readiness was established with the use of the Technology Readiness Index 2.0 (TRI2.0) of the Technology Readiness Model. In addition, the effects of age, gender and level of study on technology readiness were estimated. A self-administered questionnaire was shared with senior students within the accounting department of the selected HEI. Descriptive and inferential statistics were used to analyse the data collected from 243 respondents. The study found that Microsoft teams was the commonly used platform whilst pre-recorded lectures and live classes were the popular approaches used. In terms of technology readiness, the study found that students were not ready as indicated by a low TRI 2.0 of 2.8. Age and study level had a positive effect on technology readiness. To provide the best possible learning experiences to students, lecturers need to understand what worked, what did not and why. The results of this study provide invaluable information and lay a foundation for successful future e-learning projects.

**Keywords:** Information and Communication Technologies, remote learning, emergency remote teaching, online learning, Technology Readiness

## 1. Introduction

The covid-19 pandemic has affected many people around the world. To curb the fatalities resulting from Covid-19, several governments enacted various restrictions on the movement of people. The restrictions included country lockdowns, where educational institutions, among others, were closed. With most countries under lockdown, the only way academic studies could be continued was through the adoption and use of remote learning (Jena, 2020). Most Higher Education Institutions (HEIs) moved from face to face to exclusively remote teaching and learning and this was the case with South African HEIs that switched to remote learning albeit some did not officially announce the move (Mhlanga & Moloi, 2020). HEIs, especially those that did not have functional online learning platforms, had to adopt emergency remote teaching (ERT) methods to save the academic year.

The proliferation of multi-ICT tools and platforms has made remote teaching during the pandemic easier to achieve. Several ICT platforms were used for teaching in HE including LMSs, YouTube, Microsoft Teams, Skype, WhatsApp, Zoom, Google meet, Webex, Facebook and Instagram (Bozkurt, Jung, Xiao, Vladimirschi, Schuwer, Egorov, Lambert, Al-Freih, Pete, Olcott, Rodes, Aranciaga, Bali, Alvarez, Roberts, Pazurek, Raffaghelli, Panagiotou, Coëtlogon, Shahadu, Brown, Asino, Tumwesige, Reyes, Ipenza, Ossiannilsson, Bond, Belhamel, Irvine, Sharma, Adam, Janssen, Sklyarova, Olcott, Ambrosino, Lazou, Mocquet, Mano & Paskevicius 2020; Mhlanga & Moloi, 2020). These approaches were made possible by the use of laptops, desktop computers, smartphones and tablets (Bozkurt et al., 2020). Whilst universities had to adopt new methods of teaching and learning, it is hypothesised that most students, who are described as digital natives, would not encounter many challenges in remote learning. Today's students enter HEIs with vast knowledge and experience of computer technologies as they grew up with the technology (Basol, Cigdem & Unver, 2018). Most students have access to and are experienced in use of digital

technologies as they spend a lot of time on the gadgets (Molchanova et al., 2020). As much as most students can use ICT tools and platforms, successful utilisation of these platforms, however, requires ICT tools, internet connection and data, resources that are not always available to many students, especially those from remote rural areas (Krönke, 2020).

*1.1 Overview of the Selected HEI*

The selected HEI is a historically disadvantaged institution in South Africa, with most of its students coming from remote rural areas. Sadly, that is where ICT infrastructure is limited or non-existent. In addition, most of them do not have access to ICT devices (Krönke, 2020), data for connection and stable internet connections (Czerniewicz et al., 2020), resources that enable online remote learning to take place. Although it is claimed that students have vast experience in technology (Basol et al., 2018), most students from poor social backgrounds are only exposed to online learning platforms when they join institutions of higher learning (Czerniewicz et al., 2020). The management of the selected institution was aware of this challenge, thus, it provided needy students with laptops and data to enable learning to take place. At the time of writing, the institution used the blackboard learning management system as its official LMS. However, due to the move to remote teaching and learning, the LMS could not cope with the increased traffic flow, leading to its collapse. Whilst some functions were still operational, users were unable to perform some key functions such as uploading and downloading content. The collapse of the LMS was not an isolated case as several LMSs collapsed because of intensive use, which they were not created for (Ferri et al., 2020). As the LMS could no longer be used to deliver instruction, the management of the selected HEI instructed and encouraged lecturers to use different methods and platforms that were 'appropriate' for the continuation of teaching and learning, herein referred to as emergency remote teaching. Whilst the decision to use multi-modal approaches was a result of the collapse of LMS, some HEIs with working LMSs also allowed the lecturers to use multiple platforms and approaches. This was to enable lecturers not conversant with LMS to continue with teaching (Bozkurt et al., 2020).

The circumstances of COVID-19 have forced the education sector into uncharted waters that most lecturers never intended to venture into. The decision to allow students to use 'appropriate' methods enabled the continuation of learning. Nevertheless, it exposed students to multiple platforms and approaches, which in most cases, worked in different ways. As confessed by students in the United States of America, this approach frustrated students as they had to move from one platform to another (Pincock, 2020). Transitioning to technology during remote learning could have overwhelmed students at home learning how to use the new tools correctly and adapting to a new learning setting (O'Scanaill, 2020). It is against this backdrop that the study identified the common ICT platforms and approaches used by lecturers, assessed the readiness of students to engage in multi-modal emergency remote learning (ERL) and establish the relationship between readiness and students' age, gender and level of study.

The questions that the study attempted to address were:

- Which platforms are lecturers using during ERT at the selected HEI?
- Which online learning approaches are used during ERT at the selected HEI?
- How ready were students of the selected HEI for ERL?
- Which factors affect the ERL readiness of the students of the selected HEI?

Responses to these questions are critical for future online learning designs and implementation, a claim also echoed by Basol et al., (2018). O'Scanaill (2020) claims that lecturers should be aware of the circumstances of the students, understand what worked, what did not and why, to provide the best education.

## 2. Literature Review

Emergency remote teaching is a temporary move of instructional delivery that is otherwise face to face or blended to a remote delivery which is a response to a crisis. The primary objective of ERT is to provide temporary access to instruction in a manner that is quick to set up and is reliably available during an emergency (Hodges et al., 2020). ERT is normally carried out online as many studies have showcased (Alvarez Jr., 2020; Ferri et al., 2020; Mohmmed et al., 2020; Naffi, 2020; Shim & Lee, 2020; Trust & Whalen, 2020). Online learning (e-learning) is technology-enhanced learning that uses ICT to access programmes or courses using computer devices, which facilitate interaction among instructors, students, peers and resources as well as participation in discussions and assessments. The major difference between online learning and ERT is that online learning is properly planned for whilst ERT is a response to a crisis and temporary (Hodges et al., 2020). Because of several similarities between online learning and ERT, no further differentiation will be done in the paper.

Whilst remote learning is arguably limited in its availability to students who have access to technological facilities

necessary for this mode of learning, it does present unique opportunities and challenges (Arasaratnam-Smith & Northcote, 2017). The major benefit is the accessibility of learning anywhere whenever (Bates & Khasawneh, 2007; Jena, 2020), thus allowing access to otherwise inaccessible students (Yuhasriati et al., 2020). This gives students the freedom to structure their studies based on the time convenient and effective for them. The ability of remote learning to embrace multiple intelligences allows students to utilise their strengths and minimise their weaknesses. According to Jena (2020), remote learning offers highly effective learning environments and complementary interactive support that allows students to study 24/7 and work at their pace, a claim also echoed by Mar é and Mutezo (2020). Besides, remote learning provides a platform for introverts to participate and contribute to the creation of their knowledge (Cloete, 2017; Pincock, 2020). In addition, students would dedicate more time to studying as there will be less time spent commuting and the level of attention increased by not sitting in one place for a prolonged period (Pincock, 2020; Shim & Lee, 2020). The identified benefits of remote learning have been claimed to improve the academic performance of students (Qwabe & Khumalo, 2020).

Due to the unplanned nature of ERT, students and lecturers confronted many obstacles in accommodating and embracing emergency remote teaching and learning (Affouneh et al., 2020). Primarily, the ERT that most HEIs resorted to was dependent on the internet. To access the learning instruction, students required the data and digital devices for internet connection. In access to digital technologies including network connection are some of the commonly cited challenges that inhibited smooth emergency remote learning (Ilonga, Ashipala, & Tomas, 2020; Mohmmed, Khidhir, Nazeer & Vijayan 2020; Ferri, Grifoni & Guzzo 2020). Without access to the technologies, students cannot participate in ERL. Often, poor internet connection has been cited as another challenge faced by students and lecturers in remote learning (Alvarez Jr., 2020; Ferri et al., 2020; Naffi, 2020; Trust & Whalen, 2020). This challenge was severe to students in remote rural areas where there is limited or no ICT infrastructure. The connectivity challenge is not unique to South African and African rural areas only but is universal, with similar challenges experienced in the United States of America (Povich, 2020); Europe (Ferri et al., 2020) and Asia (Shim & Lee, 2020).

Another challenge with remote learning was the confusion of students in trying to keep track of where everything for each class was (Pincock, 2020). Because ERT was an emergency plan, there was no standard format of how lecturers organised their remote courses. A survey of US college students' perspectives about remote learning by Barnes and Noble Education, reveals that most students were concerned about the lack of motivation, inappropriate home environment and disruptions to learning associated with remote learning. Another concerning issue for students was the lack of social interactions with classmates which they believed would affect their learning (Barnes & Noble Education, 2020; Shim & Lee, 2020; Wise & Bergner, 2020). Remote learning meant that students lost rich peer communication networks, which were important to their understanding and motivation to engage and persist (Ferri et al., 2020; Jeffery & Bauer, 2020).

ERL has exposed and amplified the inequity gap between the rich and the poor (Aguliera & Nightengale-Lee, 2020; Bozkurt et al., 2020) and those in urban areas and remote areas. Affluent parents/guardians can use the resources at their disposal to make up for the limitations of remote learning. The move to online expanded the digital divide between those with access to electricity, ICT infrastructure, data and devices and those with no access (Bozkurt et al., 2020).

### *2.1 Remote Teaching Platforms and Approaches*

Remote teaching platforms used for teaching include visual, audio, video platforms or a combination of visual, audio and video. Video platforms can be prerecorded (asynchronous) or live (synchronous). Synchronous platforms available for teaching and learning include zoom, google meet, skype, YouTube Live and Microsoft Teams (Jena, 2020). These platforms enable teaching and learning to take place despite the distances between instructors and students (Weller, 2017). In ERT, lecturers made use of a variety of platforms and approaches to enable learning to continue. In addition to the official learning management systems such as Moodle, Canvas, Blackboard, Edmodo and Google Classroom, they used synchronous communication and conferencing platforms such as Zoom and Microsoft Teams, Google Meet and WebEx and live broadcasting features of social networking sites such as Facebook Live, Instagram Live and YouTube live streaming (Bozkurt et al., 2020; Johnson et al., 2020). The teaching approaches used included live virtual class sessions, prerecorded videos and voiceover narrated PowerPoint (Johnson et al., 2020).

In countries where ICT infrastructure was inadequate, mobile technologies were used to communicate and deliver educational content. Social networking and instant communication tools such as Facebook and WhatsApp messaging were used to create communication channels among students and lecturers (Bozkurt et al., 2020).

*2.2 Readiness for Remote Learning*

Readiness for online learning also referred to as e-readiness or technological readiness, refers to the keenness of students in making use of ICT in their studies (Du Toit, 2010) including how to access, evaluate and adapt resources for learning (Marinda van Zyl et al., 2013). Jena (2020) defined online learning readiness as the availability of capabilities and resources and the preparedness to perform tasks that need specialised skills and infrastructure, particularly, about ICT. Online learning readiness is possible with students having access to technology which includes devices and the internet (Coopasami, Knight & Pete, 2017). In their exploration of students' readiness for digital learning, Arthur-Nyarko, Agyei and Armah (2020) argue that access to digital technologies creates the foundation for the implementation of technology-enabled learning.

Most students, who are described as digital natives, are expected not to encounter many challenges in remote learning as they can use digital technologies. Today's students enter HEIs with vast knowledge and experience of computer technologies as they grew up with the technology (Basol et al., 2018). Young people, which most undergraduate students are, spend more time on gadgets (Molchanova et al., 2020), as a result, they have great experience in using them. Although they are proficient in common technologies, younger students are not necessarily proficient in using technologies for learning (Nami & Vaezi, 2018). There is a disconnect between the manner students interact with technology in their social and personal lives and how they use it for education (Qwabe & Khumalo, 2020). Biswas and Nandi (2020) argue that the inability to use technology for learning is a result of a lack of interest and motivation to use technology for learning compared to social use.

In their study on learner readiness for online learning, Hung, Chou, Chen and Own (2010) found college students to have high levels of self-efficacy in computer/network skills including online search and performing basic software functions. These are some of the requisite skills for successful online learning (Bozkurt et al., 2020). However, it is necessary to note that the respondents for the study were already online learners who had considerable experience in online learning. In addition, the respondents were drawn from universities in Taiwan, a country that is built on its innovativeness. In 2017, 90% of laptops sold around the world were manufactured in Taiwan (Hsieh, 2019). This is in sharp contrast to most developing countries, which are net importers of ICT equipment, making accessibility more expensive compared to the exporters of ICT equipment.

Although access and the ability to use ICT equipment are considered to be the foundation for readiness to use technology for learning, students who have been exposed to some form of online learning before seem to be more ready for remote learning than students who have not experienced it before (Caison et al., 2008; Firat & Bozkurt, 2020; Naffi, 2020). Having taken an online course before positively impacts the students' online readiness (Basol et al., 2018) and lack of experience in online education impedes students' ability to cope and master online courses (Durodolu & Mojapelo, 2020). Helsper and Eynon (2009) claim that previous experience of technology to be one of the significant descriptors of a person who was more likely to use technology. Also, this claim is echoed by Bozkurt et al. (2020) who claim that Australia's experience in online education made it well prepared for remote learning during the COVID-19 pandemic. The nature of the COVID-19 pandemic meant there was a steep learning curve and an overload of information which could have negative effects and demotivate students with no experience with online learning (Liyanagunawardena et al., 2013).

*2.3 Antecedents of Technology Readiness*

Parasuraman and Colby (2015) claim that demographic characteristics such as age and education correlate with TR, a claim also corroborated by Firat and Bozkurt (2020). Younger students have higher online learning readiness because they grew up with technology around, thus, have higher levels of technology self-efficacy than older students (McCoy, 2010). This claim is corroborated by Caison et al. (2008) and Rojas-Méndez, Parasuraman and Papadopoulos (2017) who found older students to have a low technology readiness score compared to younger ones. Mccoy (2010) found younger students to have higher self-efficacy scores. However, Blut and Wang (2020) found age to hurt the motivators of technology readiness, meaning that older people are more likely to use technology than younger ones, a finding corroborated by Firat and Bozkurt (2020). Whilst several studies found age to affect technology readiness, this is disputed by Nami and Vaezi (2018), who could not prove that younger students are better prepared for online learning. Whilst they grow up surrounded by technology and it may help them to be proficient in using common knowledge, it does not enhance knowledge of technologies commonly used in education (Lynch, 2020; Nami & Vaezi, 2018; Regmi & Jones, 2020).

Whilst it is generally agreed in theory that male students are more willing to use and learn about computers compared to females (González-Gómez et al., 2012), many prior studies carried out on gender and readiness to adopt and use technology for learning resulted in an inconsistent and wide range of findings (Goswami & Dutta, 2016). Caison et al. (2008) found male students to score higher on innovation than their female counterparts and have a higher overall technology readiness

attitude than female students, a finding that is supported by Rojas-Méndez et al. (2017). A study by Nami and Vaezi (2018) found male respondents to have higher technology self-efficacy than female respondents. The willingness of males to try new things and the joy associated with it could be the causes for the higher self-efficacy for males. Ramírez-Correa, Arenas-Gaitán and Rondán-Cataluña (2015) found enjoyment of technology to influence the ease of use by males whilst it was not the case with females, who do not consider enjoyment to be relevant. A study undertaken by Firat and Bozkurt (2020) to establish factors influencing online learning readiness found mixed results in explaining the influence of gender on online learning readiness. Whilst there was no meaningful difference between the readiness of females and males under the age of 25, there were notable differences from the age of 25. The readiness of male students decreases with ages between 25 and 35 whilst readiness for female students increases within the same range. Beyond the age of 36, the readiness of male students exceeded that of female students and the difference widens with an increase in age. Khalifeh, Noroozi and Farrokhnia (2020) undertook a study to assess the readiness of students to computer-supported collaborative learning and they found no meaningful difference between application of technology by both female and male students. This finding is shared by Hung et al. (2010), Astleitner and Steinberg (2005) and Little-Wiles, Fernandez and Fox (2014) also found no differences between male and female students in terms of online self-efficacy, technology readiness and technology use. The inconsistent findings can be attributed to a number of factors including national cultural differences, stage of country development, the timing of the studies and the methodologies and samples used for the studies. In some cultures, women are not expected to be inquisitive and as such might not be fascinated by being adventurous and thus, not keen to use technologies. According to Brown and Czerniewicz (2009), the mixed findings suggest that the issue might be context dependent and influenced by factors such as socio-economic, language, culture and subject discipline.

The level of study is also considered to influence the level of readiness and students in different levels of study are likely to have different levels of technology readiness. Blut and Wang (2020) found the level of education to be positively related to technology readiness whilst negatively related to inhibitors. Since motivators increase technology readiness and inhibitors reduces it, then the level of technology readiness is affected by the level of education. A similar finding was obtained by Rojas-Méndez, Parasuraman and Papadopoulos (2017) in their attempt to establish the effects of demographics and attitudes on technology readiness. Khalifeh, Noroozi, Farrokhnia and Talalee (2020) attribute the difference in readiness to previous student experiences in terms of technology use, which is positively related to technology readiness (Blut & Wang, 2020). This finding is corroborated by Karkar, Fatlawi and Al-Jobouri (2020) whose results confirm experience to have a positive effect on technology readiness.

Other commonly cited factors that influence the readiness of students to e-learning include exposure and access to technology (Basol et al., 2018; McCoy, 2010) and academic self-efficacy (Jung & Lee, 2018). These two factors are closely linked as owing and having access to technology would improve usage which would, in turn, affect the self-efficacy of the student. This claim is supported by Khalifeh, Noroozi, and Farrokhnia (2020) who argue that having a device would improve a student's self-efficacy as continuous use of the device would lead to the ability to use applications. Having access and exposure to technology results in the development of users' technology-related knowledge and skills (Nami & Vaezi, 2018).

### *2.4 Theoretical Framework*

There are various models used to estimate technology readiness that include Chapnick Readiness Model and Online Learning Readiness Scale (Hung et al., 2010). However, this study utilised the Technology Readiness Model developed by Parasuraman in 2000. Technology readiness (TR) refers to people's propensity to embrace and use new technologies for accomplishing goals in home life and at work. It is a result of mental motivators and inhibitors that collectively determine a person's likelihood to use new technologies (Parasuraman, 2000). TR comprises four dimensions that include optimism, innovativeness, discomfort and insecurity. Of these four dimensions, optimism and innovativeness are ''motivators,'' contributing to TR whilst discomfort and insecurity are ''inhibitors,'' discouraging its use. Optimism is conceptually a positive perception of technology that allows openness to the idea of using it while innovativeness is the ability to create and pioneer. Discomfort is a feeling of fear, uneasiness, anxiety and awkwardness resulting from the thought of using technology while insecurity refers to the mistrust emanating from the disbelief that technology is effective (Parasuraman & Colby, 2001). The TRM is illustrated in Figure 1.

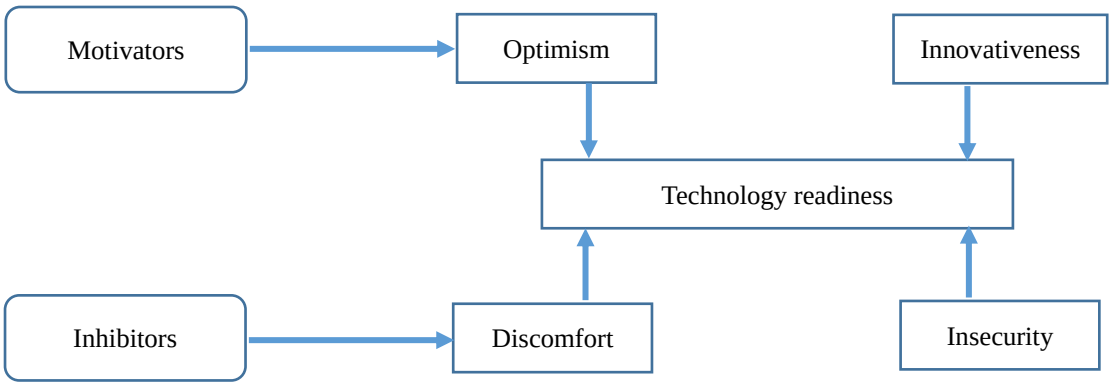


Figure 2. Technology Readiness Model

*Adapted from Parasuram and Colby 2001*

Parasuraman and Colby (2001) developed and discussed a segmentation scheme that consisted of five segments including explorers (high motivation, low inhibition), pioneers (high motivation, high inhibition), skeptics (low motivation, low inhibition), paranoids (moderate motivation, high inhibition) and laggards (low motivation, high inhibition). The five TR segments have unique demographic characteristics, for example, the segment with the highest TR score, the explorers, is younger, higher educated, more likely to work in a technology profession and owns the largest number of technology gadgets. The segments differ on demographics and behaviour (Parasuraman & Colby, 2014).

The readiness of users measured by the Technology Readiness Index 2.0 (TRI 2.0). TRI 2.0 is a survey research scale that measures and classifies individuals by their propensity to adopt and embrace technology. The TRI2.0 can be used with any population and in any type of survey and works well in different situations (Parasuraman & Colby, 2014). There are two versions of the TRI, a 16 item version and a 10 item version. The 10 item scale, which was adapted for this study, is used for studies where TR is one of the variables for the analysis but not the main focus of the research. The 10 item scale allows researchers to create an overall measure of TR. High scores in drivers and low scores in inhibitors portray a high level of readiness whilst low scores in drivers and high scores in inhibitors indicate the opposite (Parasuraman & Colby, 2001).

Whilst TRI was developed specifically for consumers in the marketing industry; it is flexible (Parasuraman & Colby, 2014) and has been used in a wide variety of investigations different sectors including higher education by Panday and Purba (2015), Khlifi and Bessadok (2015), Caison, Bulman, Pai and Neville (2008) and Elliott, Hall and Meng (2008) among others. It is for these reasons that this study adopted this model to estimate the readiness of students for ERL.

## 3. Method

### *3.1 Population and Sampling*

The targeted population for the survey was senior students (from second second-year level to fourth fourth-year level) enrolled in any programme within the Accounting and Finance department of one of the campuses of the selected HEI. First First-year students were excluded from the survey because they were new to the university environment and systems and had not met their lecturers due to lockdowns. Senior students were in the university system long enough to understand the learning management system that was used before lockdowns were implemented. At the time of the study, there were 744 students registered for programmes housed in the Accounting and Finance department: 131 first year students, 328 second year students, 207 third year students and 78 fourth year students. The questionnaire developed for the study was distributed to all second, third and fourth year students. A quantitative census sampling method was used for this study as electronic questionnaires were sent to all second, third and fourth year students enrolled in the Department of Accounting and Finance in one of the campuses of the selected HEI. No sample size was selected; all students registered in the accounting and finance department were requested to complete the survey.

### *3.2 Research Design and Approach*

The study was explanatory and primarily conformed to the quantitative research design. An explanatory study enables the examination and explanation of relationships between variables, in particular cause-and-effect

relationships (Wisker, 2008). A survey, utilising a self-administered questionnaire, which was cross-sectional, was used to gather data from the respondents.

*3.3 Sampling Procedures and Data Collection*

A non-probability convenience sampling, based on the availability of students was used to identify respondents. The survey instrument was administered to returning students enrolled in the Department of Accounting and Finance in one of the campuses of the selected institution. There were 649 returning students registered in the department in the first semester of the 2020 academic year. The study solicited responses from literate participants, thus making a self-administered questionnaire an appropriate measurement tool. In designing the questionnaire, 10 items from the Technology Readiness Index (TRI 2.0) were adapted to determine the technology readiness of respondents. Adapting questions from prior questionnaires is trusted because the questions would have been used before which increases validity (Saunders et al., 2012). The questions for the TRI were thoroughly tested for reliability and validity. Additional questions were developed to cover the other remaining objectives for the study. The questionnaire developed was shared using google forms which made it easy to export the data to Microsoft Excel.

Data were collected towards the end of the first semester of the 2020 academic year, which normally ends in June but was adjusted due to the COVID-19 pandemic. A hyperlink to the questionnaire was shared with students via their class WhatsApp groups from the 30$^{th}$ of August 2020 to the 4$^{th}$ of September 2020. Data was collected towards the end of the first semester of the 2020 academic year to allow students to experience remote learning during the earlier stage of the semester. In the study, participation was voluntary and participants remained anonymous. The key ethical issues were addressed throughout the research, especially during the data gathering and analysis stages. All respondents were informed about the purpose of the study and how the information generated was to be used. Confidentiality was guaranteed and highlighted in the introduction of the google form used for data collection. Respondents were informed of their right to privacy and refusal to participate at any point in the survey. Permission to carry out the survey was granted by the Head of the Accounting and Finance Department.

*3.4 Data Analysis*

Descriptive and inferential statistical analysis was achieved with the assistance of Microsoft Excel as well as Smart PLS 3 statistical software. Descriptive statistics were used to establish the common ICT tools, platforms and teaching approaches adopted by lecturers as well as estimating the technological readiness of students. Structural equation modelling, utilising Smart PLS 3, was used to establish the relationship between technological readiness and age, gender and level of study for the respondents. Structural equation modelling is an analytical tool that estimates coefficients in a set of linear relationships in which the functional relationships are described by parameter estimates that show the magnitude as well as the direction of effect the independent variables have on the dependent variable. It allows the researcher to explicitly accommodate measurement errors and incorporate abstract and unobservable constructs (Hair, Andersen, Tatham, & Black, 2006). In addition to establishing the relationship between variables, Smart PLS 3 was also used to establish the goodness of fit of the model used to establish the relationships.

3.4.1 Measuring Technology Readiness

To determine the readiness of students for ERL, a TRI 2.0 scale was used. The scale consists of belief statements ranging from 1.0 (strongly disagree) to 5.0 (strongly agree), with 3.0 representing the scale's midpoint (neutral). TRI 2.0 facilitates understanding the dynamics behind the adoption of various technologies by providing measures of the four TR dimensions as well as overall TR. Higher TR levels are correlated with higher adoption rates of technology. TRI 2.0 is a robust predictor of technology-related behavioural intentions as well as actual behaviours (Parasuraman & Colby, 2014). The original scale (TRI 1.0) (Parasuraman, 2000) had 36 items which were reduced to 16 items (TRI 2.0) (Parasuraman & Colby, 2014). The revised version also has a scale with 10 items which is used for studies that have technology readiness as one of the objectives as with the current study. The scale utilised for this study was a 10-item survey designed to assess the readiness of students to use emergency remote learning approaches selected by lecturers. Minor wording changes were made to some items to suit the general academic setting.

The following steps for calculating indexes from the scales were followed:

1. Determining missing values across all TR items. All missing data were given a neutral response.
2. Computing the average score for motivators and inhibitors.
3. To calculate a total TR Score, the inhibitors score was reversed by subtracting the score from 6. The TR Score was then calculated as:

$$\boldsymbol{TRI = Motivators + \left(\frac{6-Inhibitors}{2}\right)} \quad (1)$$

3.4.2 Regression Model

In addition to estimating the readiness of students for ERL, the study also established the differences in readiness based on age, gender and level of study. The intention was to establish if the aforementioned variables would impact ERL readiness. To understand the relationship between the variables in the study, a regression analysis was carried out. The following multiple linear regression model was used:

$$\boldsymbol{Y_R = \alpha + \beta_1 X_{age} + \beta_2 X_{gender} + \beta_3 X_{study\ level} + e} \quad (2)$$

where:

*YR* = Technology Readiness
*Xage* = the age of the respondent
*X gender* = the gender of the respondent
*X study level* = the year of study for the respondent

$\alpha$ is an intercept; $\beta$1, $\beta$2, $\beta$3 and $\beta$4 are parameters to be estimated; and *e* is an error term that captures all the other variables that are not included in the model but have an effect on $Y_R$.

## 4. Results

A total of 244 responses were received from a possible 613 (excluding first year students), implying a response rate of 40%. This response rate is higher than the 33% average response rate for online surveys (Nulty, 2008) and much higher than other studies that have as low as 11% response rate (Karkar et al., 2020). This could have been a consequence of the respect that lecturers who shared the survey instrument receive and the power they command by their position.

### *4.1 Profile of the Respondents*

The profiles of the students who responded to the survey instrument are summarised in Table 1.

Table 1. Composition of respondents

| Age | Female | Male | Total | Study Level | Frequency |
|---|---|---|---|---|---|
| **Below 20 years** | 8 | 2 | **10** | **Second** | 93 |
| **20 - 25 years** | 106 | 48 | **154** | **Third** | 115 |
| **25 - 30 years** | 37 | 18 | **55** | **Fourth** | 35 |
| **30 - 35 years** | 14 | 6 | **20** | | |
| **Over 35 years** | 3 | 1 | **4** | | |
| **Grand Total** | **168** | **75** | **243** | | **243** |

As shown in Table 1, the majority of respondents (69%) were females. This represents the composition of undergraduate (Bachelors, Diplomas and Certificates) students for most HEIs who are mostly females (Statistics South Africa, 2017) and is closer to the profile of students registered in the Accounting and Finance department where 67% are females while 33% are male students. Most respondents, more than 63%, were aged between 20 and 25 years old. Over 98% of the respondents were 35 years of age or less, making them digital natives according to Prensky (2001). These students are also referred to as millennials (DeChane, 2014) and computer games, email, the internet, cell phones and instant messaging are integral parts of their lives (Prensky, 2001). The millennials take lead in seizing on the new platforms of the digital era such as the internet, mobile technology and social media (Pew Research Center, 2014). This implies that most of these students are most likely to have better experience in technology use than most lecturers. In terms of year of study, most respondents were third years followed by second years whilst fourth years were the least.

Whilst the needy students were provided with laptop computers and data, it was necessary to find out which devices were students using during the period. The aim was to find out if students were using the ICT equipment provided by the institution or they were using other ICT equipment. Respondents were requested to indicate the equipment they were using for ERL and their responses are summarized in Figure 2.

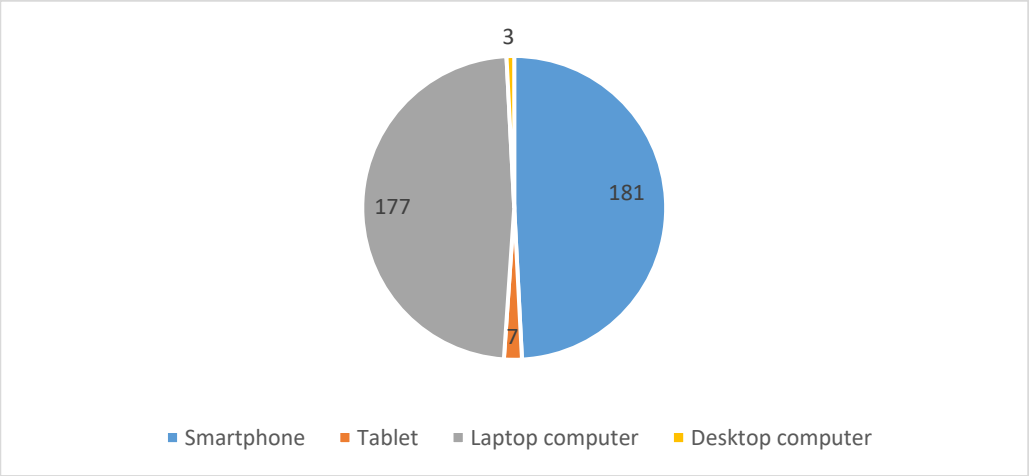


Figure 3. ICT devices used for ERL

As portrayed in Figure 2, smartphones and laptop computers were the most popular ICT devices that students were using for learning. Whilst the percentage of students utilising laptop computers was almost similar to the smartphones, this was a result of the institution providing laptop computers to students who needed such gadgets. Despite receiving laptop computers, the results show that most students still used their phones for learning. What is not certain are the uses for smartphones, whether they use for accessing materials, attending virtual classes, assessments or all. However, it has to be noted that the survey was carried out via WhatsApp where most students access it via smartphones. So, this means that the majority of students who responded had smartphones but 25% of them do not use the phones for any kind of learning. Accessibility of ICT equipment to students as shown by the results, creates a foundation for implementation of remote learning, something considered to be critical in technology readiness by Arthur-Nyarko et al (2020). According to Basol et al. (2018), owning a computer and a smartphone was positively related to students' online learning readiness.

*4.2 ICT Platforms and Approaches Used for ERT*

The respondents were requested to indicate the platforms and approaches their lecturers were using for ERT. Their responses are summarised in Figures 3 and 4.

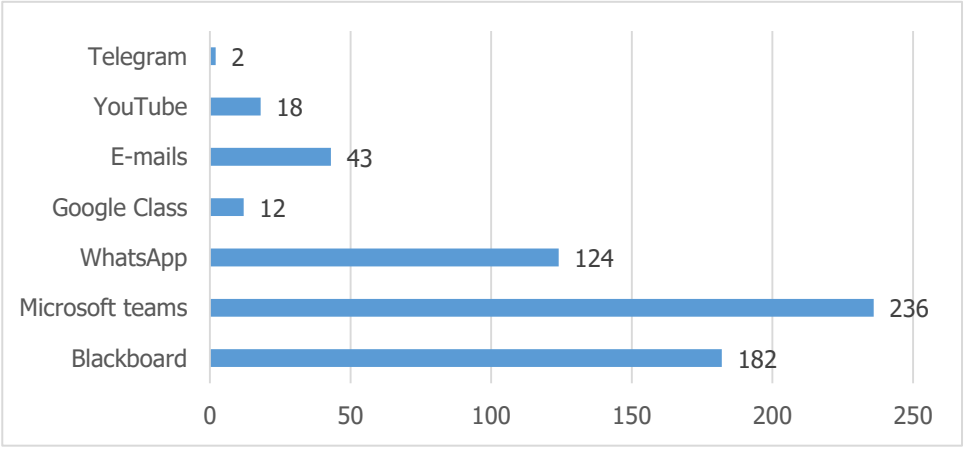


Figure 4. Platforms used for ERT

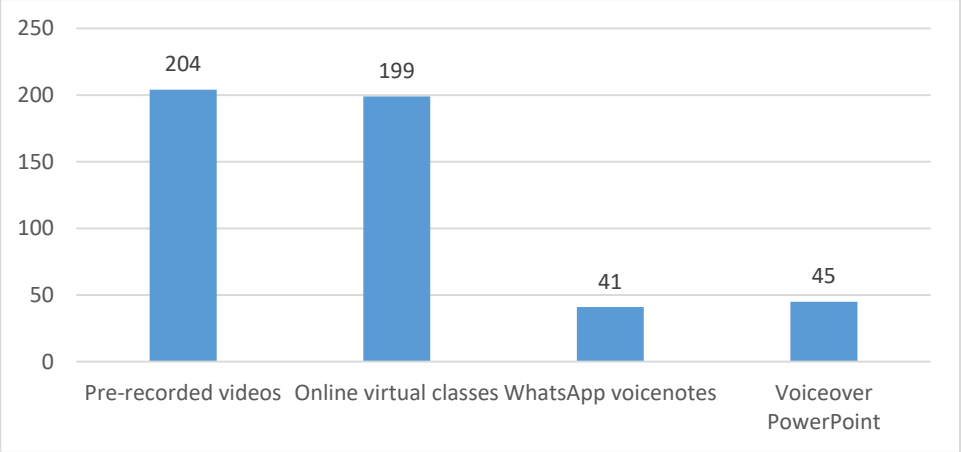


Figure 5. Approaches used

In terms of the platforms utilised for teaching and learning, most lecturers adopted Microsoft Teams, which the institution also adopted for its meetings. This was followed by Blackboard and WhatsApp. The other notable platforms were Google Class, Emails and YouTube. The fact that about six platforms were being utilised meant that students had to understand how these platforms work. Whilst students were likely to find it easy to use WhatsApp, e-mails and YouTube, they were likely to spend some time to understand how blackboard, Microsoft teams and google classwork, which was likely to take a strain on them.

Most students claimed that pre-recorded videos and live online/ virtual classes were the commonly cited remote teaching methods as shown in Figure 4. Other notable methods included WhatsApp voice notes and voiceover PowerPoint. In some cases, lecturers recorded lectures using OBS studio or MS Teams, compress them and share them with students via WhatsApp. The common characteristic of the remote methods used is that they all included audio, something that is likely to aid in elucidating concepts compared to texts.

*4.3 Students' Readiness to ERL*

To assess the readiness of students for ERL, the TR score, based on the average scores for the motivators (innovativeness, optimism) and inhibitors (discomfort, insecurity) was calculated. The TR scores range from the lowest score of 1 to the highest of 5. The higher the score, the readier the student was for the ERL. The TR scores for the respondents are presented in Table 2.

Table 2. Readiness for ERL

| | Min | Max | Mean | Standard deviation |
|---|---|---|---|---|
| **Motivators** | 1.00 | 4.80 | 2.50 | 0.72 |
| **Inhibitors** | 1.00 | 5.00 | 3.10 | 0.90 |
| **TRI2.0** | 1.50 | 4.30 | 2.80 | 0.57 |

The results of the survey show TRI2.0 of 2.80 indicating that the respondents from the HEI under study were neutral in their readiness for ERL. This can be interpreted as not being ready for technology in teaching and learning. Whilst the majority of students can be referred to as digital natives and are capable of using technology, they are not ready to use it for teaching and learning. A further look into the results shows that the students lacked motivation for use of technology as shown by an average score for motivators of 2.5. This implies that the students were not high on innovativeness and optimism.Conversely, they did not experience considerable discomfort and insecurity due to ERT practices as shown by an average score for inhibitors of 3.1.

*4.4 Relationship between Dependent and Independent Variables*

4.4.1 Measurement Model

The validity and reliability of the 10 item scale were not tested as these were previously established by Parasuraman and Colby 2014). The influence of the 10 items on explaining technology readiness was, however, determined by establishing the factor loadings of the items using Smart PLS 3. A table with factor loadings for all the original ten items is presented in Appendix A. As a rule of thumb, values above 0.5 for factor loadings are considered acceptable (Hair, Black, Babin & Anderson, 2010). Five items from the scale had factor loadings below 0.5, showing a weak

influence on technology readiness. In an attempt to improve the model, the item with the lowest factor loading was removed from the scale and factor loadings for the remaining items recalculated. This process was repeated until all items in the scale had factor loadings above 0.5, resulting in a scale with four items. These items and the related factors loadings are presented in Table 3.

Table 3. Factor loadings for remaining items

| Item | Factor loading |
|---|---|
| Use of online learning gives me more freedom of mobility (OPT1) | 0.801 |
| Technology makes me more productive in my learning (OPT2) | 0.845 |
| My peers and friends come to me for advice on new learning platforms (INNO1) | 0.639 |
| I keep up with the latest technological developments in my areas of interest (INNO3) | 0.652 |

It is worth noting that the items that remained with acceptable factor loadings were all from the motivators. All items from the inhibitors had below acceptable factor loadings. This experience is not new to this study as the test by Khlifi and Bessadok (2015) on the 36-item scale resulted in 15 items being eliminated as they had factor loadings below 0.5.

4.4.2 Structural Model

Structural equation modelling (SEM), utilising SmartPLS 3, was used to test the model developed. The strength of each causal relationship is measured using path coefficients size and p-value (Abdullah & Ward, 2016). The sign on the path coefficient indicates the type of relationship between variables that would either be positive or negative (Ringle et al., 2015). The t-statistic and p-values are normally used to identify statistically significant relationships between latent variables. A statistically significant relationship between variables is indicated by a t-statistic above 1.69 and a p-value equal to or less than 0.05 (Ringle et al., 2015). As such, in interpreting the results, statistically significant relationships were the ones that had *p*-values of ≤0.05 and/or t-statistic above 1.69. The results of the regression tests are presented in Table 4.

Table 4. Bootstrap results

| | Path coefficients (β) | T Statistics | P Values |
|---|---|---|---|
| **AGE <- Predictors** | 0.796 | 7.335 | **0.000** |
| **GENDER <- Predictors** | 0.131 | 0.556 | **0.578** |
| **STUDYLEVEL <- Predictors** | 0.841 | 7.498 | **0.000** |

As shown in Table 4, the age and study level have p-values less than 0.05 and t-statistics of more than 1.69, implying causal effects on technology readiness. Thus, the age and level of the study have a positive causal effect on the readiness of students for ERL. The results show that older students were more prepared for ERL than younger ones. Besides, the results show that students studying at higher levels were more prepared for ERL than those at lower levels. The relationships between age and readiness and study level and readiness are very strong as portrayed by path coefficients that are closer to 1 (Age = 0.796; Study level = 0.841). No significant relationship was, however, found between the gender of respondents and level of readiness for ERL as shown by path coefficient, t-statistic and p-value of 0.131, 0.556 and 0.578 respectively.

## 5. Discussion

The results of the study show that Microsoft Teams and Blackboard were the commonly used platforms for teaching and learning. Since blackboard was not fully functional, it was primarily used as a repository where a student could access content such as PowerPoint slides, prerecorded videos and links. Microsoft Teams was adopted as an alternative to Blackboard. Although its main purpose was for live online classes, it was also used for storing course content and conducting assessments. The likely reason for using MS Teams for storing content could have been to provide multiple alternatives to students who would have challenges in accessing Blackboard. It would also make it possible for students to access all course content on one platform. The platforms and approaches found in this study are not unique to the selected institution alone; several studies had similar findings. Many HEIs used their LMS as well as other platforms such as MS Teams, Zoom, WhatsApp and YouTube for teaching (Bozkurt et al., 2020; Lynch, 2020; Mhlanga & Moloi, 2020). Nonetheless, there were limited options for the selected institution compared to others which used a wide range of platforms that included Facebook live, Instagram live, Google hangouts in addition to MS Teams, Zoom as commonly cited in the literature (Bozkurt et al., 2020). Whilst the selected

department had few options, it could have helped students to cope with the changes to learning as it meant learning to use fewer platforms. As found in this study, Live online classes and pre-recorded videos were the predominant approaches used in remote teaching around the world (Bozkurt et al., 2020; Cecilio-Fernandes et al., 2020; Johnson et al., 2020; Mohmmed et al., 2020). As in the current study, other notable approaches included WhatsApp chats and voice notes and voiceover PowerPoint (Johnson et al., 2020; Mohmmed et al., 2020).

*5.1 Readiness for Remote Learning*

The finding was unexpected as the range of the students who participated in the survey can be described as a network generation, thus, were expected to be comfortable with technology-related learning. Therefore, it was expected that they would be ready to adopt multi-modal remote learning, an argument also presented by Khalifeh et al., (2020). Yet, this finding was not surprising as most students understand and have experience in using technology for social activities, an experience that does not necessarily translate to experience for use in learning. Although most students are proficient in the use of common technologies, because they are surrounded by technology, that does not necessarily improve their knowledge of technology commonly used for educational purposes (Nami & Vaezi, 2018). This claim is also echoed by Coopasami, Knight and Pete (2017) who found students to have high general technological readiness but not ready for online learning requirements. Though, this finding differs from the study by Hung, Chou, Chen and Own, (2010) who found college students to have high self-efficacy for online learning. It is necessary to note that the respondents for their study were already online learners who might have gained experience in online learning. In addition, the respondents were drawn from universities in Taiwan, a country that is built on its innovativeness. In 2017, 90% of laptops sold around the world were manufactured in Taiwan (Hsieh, 2019). This is in contrast with the current respondents who were not exposed to proper remote learning before Covid-19. In addition, many black South African students who are in this study, come from poor backgrounds and have not had experience with computers before entering higher education (Zimba et al., 2020).

The low score for technology readiness found for the study may be a consequence of connectivity issues (network and data) which might have made students have low motivation. Whilst students were provided with computer laptops and data for internet connection, these could not be fully utilised as some students had slow or no internet connections. The majority of students reside in rural areas where network connectivity is still poor and as such, found it difficult to download content and participate in virtual classes. Such challenges inhibit the effective use of technology for learning as argued by Durodolu and Mojapelo (2020). The challenges are not only common to historically disadvantaged institutions but also advantaged ones (Krige, 2020).

*5.2 Factors Impacting Readiness for Remote Learning*

The study found age and study level to having a very strong positive influence on readiness to ERL. This is portrayed by high path coefficients (age = 0.796; study level = 0.841) that are closer to 1, implying a very strong relationship. These imply that older students and most senior students in the sample were more ready for ERL than younger and junior students. The finding that older students resemble more readiness for technology contradicts TRM which argues that younger people are more inclined towards the use of technology compared to older ones. The ambiguity of ‘young’ and the context of the HEI used may explain the contrasting findings. Whilst the respondents were categorised into some age groups, they may all be considered young, so it becomes a question of which ‘young’ is considered ready.

The results show that students at higher levels of study were better prepared for ERL than those at lower levels. This may be explained by the experience in technology that students obtained at lower levels of study. Most students who join the selected HEI are from poor backgrounds and most of them are exposed to ICT when they join the university. Therefore, it takes that their experience would increase as they move up the study levels and as such, senior students are more likely to be ready for technology use than junior students. The improved readiness in older students can be a result of experience gained through the use of technology in earlier years of tertiary education. Also, this argument is postulated by McCoy (2010) who claim that an increased length of exposure to technology would lead to enhancement of skills, which in turn improves readiness for any similar technology.

Prior experience in technology, which is primarily influenced by access to technology, influences self-efficacy (Money & Dean, 2019), which in turn, influences the level of readiness for use of technology for learning. This may be the reason why students at higher levels of their study were ready for ERL as they experienced from the first year of study. The first hurdle of having access to technology was fulfilled by the selected institution by providing digital tools and data, creating an adequate basis for technology readiness. The second aspect is the experience in the use of the technology, which is impacted by the length of time a student had access to technology. Those students who had access to technology for longer had higher levels of self-efficacy, which improved their levels of readiness for

METTL. This is confirmed in the findings of the study where the level of the study had a positive influence on the level of technology readiness. Students at higher levels, hence more experienced, had higher levels of technology readiness than students at lower study levels.

Although the current study identified age as an antecedent to technology readiness, Money and Dean (2019) did not find age to have any meaningful influence on online educational outcomes. The findings on the effect of gender on technology readiness are in sync with some studies (reference) but also contradicts some (Nami & Vaezi, 2018; Parasuraman & Colby, 2014) that found gender to affect technology readiness.

The findings of this study can be summarised as follows:

- Microsoft Teams and Blackboard are the commonly used platforms for teaching and learning;
- Live online classes and pre-recorded videos were the main approaches to remote teaching;
- Students were not ready for remote learning;
- Age of students and their level of study had a positive influence on readiness for remote learning.

## 6. Limitations and Areas for Further Research

The study sample was based on respondents from one department of a single institution and as such, the findings cannot be generalised to the whole university and all universities. The results of the relationship between age, gender, study level and technology readiness were based on only four items of the 10 item scale that measure technology readiness. Although it is claimed that TRI applies to many sectors, there is a need for further evaluation to assess its applicability to higher education contexts.

## 7. Conclusion

Covid-19 exposed the societal inequalities but at the same time, it fast tracked embracing the fourth industrial revolution concepts in education. Results of this study show the unreadiness of students to fully engage in remote learning. The finding that the level of study influences the readiness for remote learning is a testament that most students, especially from poor schooling background, are exposed to technology for learning when they join the HE. Thus, it is recommended that HEIs develop interventions to allow a smooth transition of students from high schools to HEIs. Such interventions would improve the self-efficacy, thus readiness of students to utilise technology for learning. Also, the study findings inform the instructors of the level of technology understanding by their students and thus, aid them in planning for teaching and learning. It is unlikely that HEIs will revert to the traditional ways of teaching preCovid-19 (Kendall, 2020). This implies an understanding of the experiences of students during remote learning would provide invaluable information and lay a foundation for future online learning projects, a claim also made by Basol, Cigdem and Unver. O'Scanaill (2020) argues that lecturers should be aware of the circumstances of the students, understand what worked, what did not and why, to provide the best education. As found in the study, students at lower levels of study need not be immersed in too many technologies without guidance and assistance as they lack understanding of the teaching technologies.

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## Appendix A

**Factor loadings for the items in the scale (Note 1)**

| Item | Factor loading |
|---|---|
| Use of online learning gives me more freedom of mobility (OPT1) | 0.645 |
| Technology makes me more productive in my learning (OPT2) | 0.721 |
| My peers and friends come to me for advice on new learning platforms (INNO1) | 0.557 |
| In general, I am among the first in my circle of friends to acquire new technology when it appears (INNO2) | 0.347 |
| I keep up with the latest technological developments in my areas of interest (INNO3) | 0.478 |
| Technical support lines are not helpful because they don't explain things in terms I understand (DIS1) | 0.423 |
| Sometimes, I think that technology systems are not designed for use by ordinary people (DIS2) | 0.511 |
| Students are too dependent on technology to do things for them (INS1) | 0.061 |
| Too much technology distracts students to a harmful point (INS2) | 0.531 |
| Technology lowers the quality of relationships by reducing personal interaction (INS3) | 0.465 |

**Note**

Note 1. These questions comprise the Technology Readiness Index 2.0 which is copyrighted by A. Parasuraman and Rockbridge Associates, Inc., 2014. This scale may be duplicated only with written permission from the authors.