SACJ 34(1) July 2022
Research Article

Understanding age differences in technophobia: A South African case study

Samuel T. Faloye, Sanjay Ranjeeth, Sonny Ako-Nai

Discipline of Information Systems and Technology, University of KwaZulu-Natal, Pietermaritzburg, South Africa

ABSTRACT
Over the years, technology has become an essential part of our lives, with technological advancement presenting on-going opportunities. However, technology creates negative emotions, anxiety and fear among some people due to an established set of norms and individual behaviour patterns. Such fear, anxiety and apprehension has been described as technophobia, which constrains individuals' ability to use technology and thus puts them at a disadvantage. The continuous emergence of new technologies has given rise to increased technophobia, which is now believed to affect a third of every population. This article examines age differences in the level of technophobia as well as the personal characteristics that positively influence it. A quantitative methodology was employed, and 384 questionnaires were distributed to participants in Pietermaritzburg, KwaZulu-Natal, South Africa. The findings show that technophobia occurs within all age groups (the young, middle-aged and older). However, young adults with no formal education and employment demonstrated lower levels of technophobia than other age groups. The results also demonstrate a significant relationship between levels of technophobia and the demographic profile of respondents. The article concludes with a discussion on strategies to manage technophobia.

Keywords: technology, technophobia, computer anxiety, negative attitude, gender

Categories: • **Human-centered computing** ∼ **Human computer interaction (HCI), HCI design and evaluation methods, Usability testing, Social and professional topics, User characteristics, Age**

Email:
Samuel T. Faloye temitayofaloye@gmail.com (CORRESPONDING),
Sanjay Ranjeeth ranjeeths@ukzn.ac.za,
Sonny Ako-Nai akonaia@ukzn.ac.za

Article history:
Received: 30 November 2021
Accepted: 2 June 2022
Available online: 22 July 2022

1 INTRODUCTION

Technologies play a crucial role in modern societies and have transformed individuals' lives. In modern times, people no longer have to leave home to make purchases as multiple e-commerce applications have enabled online shopping. Technology has also been found to enhance the older generation's quality of life. For instance, gerontechnology helps this generation live a more independent and healthier life while engaging socially on a daily basis (Adjin-Tettey, 2020; Khasawneh, 2018b; Nimrod, 2018). For this reason, it has become important for individuals, irrespective of age, to be able and willing to use it. However, among some people,

Faloye, S.T., Ranjeeth, S., and Ako-Nai, S. (2022). Understanding age differences in technophobia: A South African case study. *South African Computer Journal 34*(1), 35–60. https://doi.org/10.18489/sacj.v34i1.1039

SACJ is a publication of the South African Institute of Computer Scientists and Information Technologists.
ISSN 1015-7999 (print) ISSN 2313-7835 (online).

technology creates negative attitudes, fear and anxiety that often result in total avoidance. Such avoidance is termed technophobia. Technophobic individuals regard technology as a threat to jobs and feel that it is destroying established ways of life (Di Giacomo et al., 2019).

While the terms, technophobia, computer anxiety, and technophilia are often used interchangeably, they are distinct conditions. Technophobia is deemed to be broader than computer anxiety since it focuses on broader concepts such as attitudinal responses and aversive behaviours towards all forms of technology. Computer anxiety mainly refers to the negative feelings associated with the use of a computer (Singh et al., 2019). Both anxiety and a negative attitude are regarded as the antecedents of technophobia. Technophilia is enthusiasm for the adoption of various technologies. However, there is a paucity of research on technophilia and technophobia as scientists continue to focus on new discoveries rather than evaluating users' behaviour, attitudes and emotions towards existing technologies (Di Giacomo et al., 2019).

In recent years, technophobia has been on the rise due to the continuous emergence of new technologies, and it is estimated to affect about a third of all populations. Technophobia is prevalent among older adults, and it is thus believed that this age group is less likely to adopt technology due to anxiety, negative attitudes and other factors. Furthermore, older adults were exposed to technology late in life and often lack confidence and are challenged by technologies. This sometimes results in total avoidance of technology. However, young adults, whom some authors refer to as digital natives, are believed to possess the required skills due to their early exposure to technology and the fact that they were born in the digital era. Nonetheless, it remains uncertain whether young adults also exhibit negative attitudes and anxiety towards technology. It is also not known whether technophobia is prevalent within older or young adults, as studies on age differences in technophobia have produced mixed results.

The South African government is committed to integrating all citizens into the information society, irrespective of age and several initiatives have been launched to address technophobia, particularly among older adults; this involves skills acquisition. Non-profit organisations that serve older adults have also crafted strategies to ensure that their information needs are met. However, technophobia remains a major issue in South Africa, limiting technology adoption. The literature notes that it is commonly assumed that people aged 55 and older are often technophobic due to their late exposure to technology. For this reason, interventions to address technophobia in South Africa have mainly focused on adults. It is thus crucial to investigate technophobia in relation to the adoption of Information Communication Technology (ICT) among both young and old adults. It is against this background that this study aimed to determine whether there are age differences in the level of technophobia among individuals as well as whether or not technophobia is associated with personal characteristics.

2 LITERATURE REVIEW

Technophobia has been defined as irrational fear, anxiety and apprehension towards new technologies that manifests in the person's unwillingness to adopt various forms of technology

(Kamberidou & Patsantaras, 2004). The term technophobe refers to an individual who resists the use of technologies, while technophile describes an individual who is attracted to technology (Di Giacomo et al., 2020). Technophobia was depicted in literary works such as Frankenstein by Mary Shelley and movies such as Charlie Chaplin's Modern Times.

The literature identifies three dominant types of technophobes, namely, cognitive technophobes, uncomfortable users, and anxious technophobes. Externally, the cognitive technophobe appears to be cool, calm and collected, internally, such individuals often bombard themselves with negative cognitions (Brosnan, 1998). For instance, a cognitive technophobe will say "I am going to lose all my work"; or "Everyone except me seems to know what they are doing with this computer". Cognitive technophobes have low levels of confidence and competence in the use of technology, which often leads to avoidance (Brosnan, 1998; Di Giacomo et al., 2019). Uncomfortable users are slightly anxious about technology due to a lack of (or insufficient) information on how to use it effectively for maximum productivity (Brand & Fischer, 2013; Brosnan, 1998). Finally, the anxious technophobe demonstrates a high level of anxiety when there is a need to use technology. When forced to interact with technologies, such individuals show classic signs of anxiety including shivering, palpitations and sweaty palms. However, according to Blignaut et al. (2009), while some technophobes completely avoid the source of anxiety, resulting in poor performance, this is not true of all such individuals.

One of the first major studies on technophobia was carried out by Rosen, Sears and Wells (1987). However, this research was limited to technophobia in relation to computers, which impacted the measurement scale developed to measure technophobia. Nonetheless, it laid the foundation for further research on this phenomenon. With regard to age differences, using Rosen et al.'s (1987) scale, age was found to be positively correlated with technophobia. This finding is supported by those of later studies by Anthony et al. (2000) and Nimrod (2021). Using the measurement scale (the Computer Anxiety Rating Scale) developed by Rosen et al. (1987), these authors concluded that computer anxiety increases with age. In contrast, Bozionelos (2001), Di Giacomo et al. (2020), Dinello (2006) and Dyck et al. (1998) found that older adults demonstrated less anxiety than younger adults. They attributed this to older adults' experience and increased exposure to technology that is particularly useful to older and retired people. However, Khasawneh (2018a) indicated that the impact of age on anxiety and attitude is not easily observed, especially when the age range is narrow.

Hogan (2009) compared the impact of age on anxiety and attitude among individuals below the age of 30 and those aged 55 and older. The study found that, despite early exposure to and experience with technology, the young adults demonstrated high levels of anxiety and negative attitudes while the older participants were less anxious and exhibited positive attitudes. However, this should not be taken to mean that experience results in greater anxiety as several studies have shown that it leads to less anxiety among different age groups (Awofala et al., 2019; Brosnan, 1998; Lee et al., 2019; Nimrod, 2018). Generally, younger individuals are expected to be more proficient and technologically inclined; this notion might have resulted in greater anxiety. Similarly, the older generation are expected to be less proficient in the

use of technologies (due to late or lack of exposure) (Brosnan, 1998); this might have resulted in less anxiety.

For both the younger and the older generations, the age at which an individual is exposed to technology is considered a salient factor (Brosnan, 1998; Dinello, 2006). According to Awofala et al. (2019), in general, males' first interaction with computer and related technologies often takes place earlier than females. This is important as Adjin-Tettey (2020) showed that early use of technology often results in less anxiety and readiness to use it. However, Hogan (2009) found that males tend to have higher levels of "beginning skills" (through toys, computer games, computer puzzles, etc.) than females. This implies that a person's age when they first interact with technology impacts the level of anxiety that they experience in relation to it.

2.1 Technology anxiety

Epstein (1985, p. 334) defined anxiety as "a state of diffuse arousal following perception of threat, alternatively, as unsolved fear". Blignaut et al. (2009) describe it as an unpleasant, vague sense of apprehension accompanied by autonomous symptoms. Several studies (Bozionelos, 2001; Brosnan, 1998; Epstein, 1985; Tsai et al., 2020) have identified anxiety as a symptom of modern times which stems from the on-going evolutionary nature of technology and subsequent pressure for social change.

Computer anxiety has been identified as one of the anxieties commonly associated with human beings and it has gained traction due to the pervasiveness of personal computers (Anthony et al., 2000; Khasawneh, 2018b). Most definitions of such anxiety revolve around feelings of aversion, fear, and discomfort resulting from actual or anticipated interaction with a computer. For instance, Khasawneh (2018b) defined computer anxiety as a user's fear or apprehension when faced with the possibility of using a computer. Similarly, Di Giacomo et al. (2019) noted that it refers to fear and suspicion among people unfamiliar with computers. Other researchers (Blignaut et al., 2009; Sigit, 2021) assert that it is a negative emotion evoked as a result of actual or anticipated interaction with computers. In a few instances, computer anxiety may involve mixed feelings and the worry individuals experience in actual or future interaction with a computer (Bozionelos, 2001). The following behaviours are associated with people who experience computer anxiety:

- Computer avoidance
- Errors and excessive caution when using a computer
- Negative views of computers (Brosnan, 1998).

Often linked with computer anxiety, computer phobia refers to a negative attitude towards a computer (Khasawneh, 2018b). While Rosen et al. (1987) note that it can take the form of resistance to talking or thinking about computers, Kennedy (1988) states that it causes hostile and aggressive thoughts about computers.

https://doi.org/10.18489/sacj.v34i1.1039

Antecedents of computer anxiety include perceived loss of control, fear of negative evaluation and unfamiliarity with the language of instruction. In the studies by Di Giacomo et al. (2019) and Anthony et al. (2000), it was shown that females who follow a non-science academic path demonstrate high levels of anxiety. Similarly, many previous studies found that females demonstrate higher levels of computer anxiety than males (Awofala et al., 2019; Blignaut et al., 2009; Charles, 2020; Lee et al., 2019). This could be due to underrepresentation of females in courses like maths, and computer science. Furthermore, as noted previously, males are likely to have access to computers from an earlier age than females (Adjin-Tettey, 2020).

While technology has been considered a useful tool for the older generation and retired individuals, no positive correlation has been found between age and computer anxiety. Rather, time of access has been found to be significant (S. Faloye et al., 2022). The notion that individuals over the age of 55 tend to be highly anxious about using computers was disproven by Nimrod (2021) and Martínez-Córcoles et al. (2017). The comparison of anxiety in relation to computer use among students below the age of 30 and individuals 55 and older conducted by Brosnan (2002) showed that, despite the younger group having more computer experience, the older group was less anxious and demonstrated a positive attitude towards computers. However, this should not be taken to mean that more experience leads to greater anxiety, as research has shown that those with more experience are generally less anxious (Dinello, 2006). Research has shown that individuals with greater experience are generally anxious (Brosnan, 1998; Dinello, 2006; Dyck et al., 1998; Rosen & Weil, 1995). The dialectic discourse on experience and computer anxiety has not produced a unanimous outcome on the role that each of these factors play.

According to Blignaut et al. (2009), computer anxiety can be approached from three perspectives, namely psychological, sociological and operational. These are discussed as follows:

- *Psychological perspective* – This is demonstrated when a user perceives that they may damage a computer or feels threatened when having to ask for assistance.
- *Operational* – This is reflected when an individual seeks to avoid the embarrassment associated with low levels of competency or inability to use a computer or its accoutrements (e.g. a keyboard).
- *Sociological* – This arises from the belief that computers are likely to destroy existing social patterns (i.e. human interaction) and the essence of society.

People who exhibit computer anxiety or negative attitudes (computer phobia) often avoid computer usage (Dos Santos & de Santana, 2018). While anxiety affects individual performance, technology avoidance triggered by anxiety and computer phobia impacts an individual's mental health, and quality of life.

2.2 Attitude

According to Ajzen and Cote (2008), attitude refers to "a learned predisposition to respond in a consistently favourable or unfavourable manner with respect to an object". Blignaut et al.

(2009) defined attitude as a "mental and neural state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related". Attitude towards technology can be positive or negative; however, according to Romero Martínez et al. (2020), it is determined by individuals' experience and the potential impact on their behaviour. Attitude towards technology determines one's performance and satisfaction.

Epstein (1985) describes a positive attitude as "pro-computer", while a negative attitude is an "anti-computer" one or simply dislike or aversion towards computers and related technologies. Several factors are considered to determine computer attitude, including competence level, anxiety, a liking for computers, and issues around their usage and usefulness (Blignaut et al., 2009). For instance, someone with a positive attitude towards computers demonstrates excitement and willingness to use and learn about them, while a negative attitude leads to resistance. In a few cases, a negative attitude may also lead to destructive behaviour in relation to computers and related technologies.

2.3 The relationship between computer anxiety and computer attitude

Previous studies considered computer anxiety as an essential element of attitude (Blignaut et al., 2009; Loyd & Gressard, 1984). However, a major limitation of these studies is the interchangeable use of the concepts computer anxiety and a negative attitude towards computers. A negative attitude is not only the result of anxiety. For instance, a previous negative experience may cause a person to adopt a negative attitude towards computers even though he/she is not overanxious about using one. Thus, attitude is not necessarily caused by anxiety (Blignaut et al., 2009).

2.4 Technophobia in South Africa

A number of studies have been conducted on technophobia around the globe. However, very few have been conducted in South Africa. While previous studies (Cai et al., 2017; Schlebusch, 2018) investigated general attitudes to technology, only four (Anthony et al., 2000; Clarke, 2000; Khululwa & Newlin, 2018; Kotze et al., 2012) focused on technophobia; furthermore, they only investigated it with regard to computers and not technologies of various kinds, as was the case for this study. The research of Anthony et al. (2000) that examined technophobia in South Africa was restricted to consumer products in the business context. A synopsis of each of these studies is provided in the discussion that follows.

The Anthony et al. (2000) study which focused on technophobia and personalities was conducted at the University of Natal (now the University of KwaZulu-Natal (UKZN)). It found no association between technophobia and gender and, in general, the results support those of studies conducted in other contexts (Ajzen & Cote, 2008; Bozionelos, 2001; Brosnan, 1998; Dinello, 2006; Hechanova & Dioquino, 2004; Hogan, 2009; Jeong, 2001; Mcilroy et al., 2007). Clarke (2000) surveyed 176 students on UKZN's Pietermaritzburg campus and concluded that,

while gender influenced attitudes towards computers 33 years ago, this is no longer the case. This could be attributed to the fact that many female students have studied for IT and computer science qualifications, which increased their exposure to IT domains (and opportunities) that were previously dominated by males (Kennedy, 2018; Martínez-Córcoles et al., 2017).

Anderson (2011) conducted a study at the University of Pretoria that focused on technophobia's impact on the adoption of high technology products in a marketing context. It found that black consumers are generally disadvantaged in terms of education, asset ownership and exposure. They are thus less likely to have access to high technology products and are likely to adopt negative attitudes and high anxiety towards technologies. These findings are in line with those of Clarke (2000) that showed that Zulu speakers are more technophobic than English speakers.

Clarke (2000) also observed an interesting variation between the affective and cognitive dimensions of technophobia. Male participants in the study exhibited more positive cognition of computers than females. However, male and female students with more experience of computers demonstrated low technophobia for both the cognitive and affective dimensions. In contrast to studies in other contexts (Farhan et al., 2020; Nimrod, 2021; Sigit, 2021; Svenningsson et al., 2021; Tsai et al., 2020), Clarke (2000) found that older students in South Africa exhibited less anxiety than their younger counterparts. While this finding contradicts the common assumption that older individuals tend to be technophobic, they cannot be generalized given the small age range among the first-year students that participated in the study. Furthermore, Clarke (2000) showed that despite the fact that students had technological experience, they demonstrated high levels of computer anxiety.

Kotze et al. (2012) also conducted a study at the University of Pretoria and observed gender differences, with female students demonstrating higher levels of technophobia than male students. This outcome resonated with the outcome of studies with a similar research agenda (Di Giacomo et al., 2019; Hogan, 2009; Khasawneh, 2018b; Nimrod, 2018). Also, Anderson (2011) concluded that females were less optimistic about using technology and exhibited higher levels of risk aversion than males. The literature shows that, when a new technology emerges, males are more willing to adopt it, while females prefer to adopt it at a later stage when it has been proven its reliability has been confirmed. The findings from Kotze et al. (2012) and Anderson (2011) could be linked to societal attitudes towards technology in South Africa and other developing countries. According to S. T. Faloye and Ajayi (2021), technology engagement is generally perceived in South African society as a male-dominated activity while females traditionally have a more domesticated responsibility. This has created a psychological barrier for females intending to pursue careers in the technological realm. Thus females, particularly those who are educationally disadvantaged, may hold negative attitude and high anxiety towards technology, the antecedents of technophobia.

While Clarke (2000) found no significant relationship between home language and technophobia, there are a number of reasons why his findings cannot be generalized to the broader South African population. Firstly, the majority of South Africans, particularly black people, have low levels of formal education (S. T. Faloye et al., 2020; Jantjies, 2020) and Clarke's

sample consisted of educationally advantaged university students at UKZN. While home language may offer an indication of cultural background, it does not reflect the quality of a student's education. A number of studies (Bornman, 2016; Cox et al., 2018; S. T. Faloye & Ajayi, 2021) have shown that educationally disadvantaged individuals are less likely to have access to modern technologies; for this reason, they tend to exhibit different levels of technophobia from those who are from privileged backgrounds and are educated (like the sample used in the Clark (2000) study). Secondly, as at 2018, isiZulu was the home language of 25% of South Africans, with Afrikaans at 12.2% and English at 8.1% (South African Institute of Race Relations, 2019). The proportion reflected in Clarke's (2000) sample was 12% isiZulu,, 2% Afrikaans and 75% English. The imbalance in representation between the different ethnic groups could render the outcome of studies on technophobia to be misleading. The importance of ethnic focus in studies on technophobia is highlighted by Anthony et al. (2000) where it was showed that isiZulu speakers are significantly more technophobic than English speakers.

Anthony et al. (2000) also established a correlation between neuroticism and technophobia. Neuroticism is an indicator of one's susceptibility to psychological distress. Common symptoms are depression, anxiety, vulnerability to stress and impulsiveness. Individuals with high levels of anxiety tends to be fearful and nervous of different stimuli which stem from personal activities (or engagement) and environments (Crabbe, 2018; Powell, 2013; Raub, 1981). Therefore, people who exhibit high levels of neuroticism are likely to suffer from high levels of stress and anxiety during interaction with technologies, particularly first time users. Furthermore, anxiety and stress levels are likely to be higher when they engage with technological devices or software with a poor user interface.

3 METHODOLOGY

Following a review of the methodologies employed by previous studies on technophobia in the South African context, a quantitative research methodology was deemed appropriate for this study conducted in Pietermaritzburg, KwaZulu-Natal Province, South Africa. The target population was young and older adults of all races. A non-probability purposive sampling technique was used to select the sample. This enables deliberate identification and selection of individuals that have characteristics that fit the phenomenon of interest. The sample size for the study was selected in accordance with Krejcie and Morgan (1970)'s sampling table. The target population for the study was 618 000, and a reliable sample size of 384 was identified. A semi-structured questionnaire consisting of 16 Likert scale type questions that were aligned to the study's main constructs was administered to the study's respondents. An isiZulu version of the questionnaire was made available upon request. The questionnaires were physically handed out to the study's respondents.

https://doi.org/10.18489/sacj.v34i1.1039

3.1 Framework

Despite the relevance of technophobia in the modern world, there is a dearth of studies that evaluate it in the general sense. Previous studies focused on technological innovations and advancement (Khasawneh, 2018b). In addition, most studies and frameworks that have been developed to measure technophobia, defined it within the narrow context of computer usage. However, technophobia is a phenomenon that is intertwined with a multitude of technologies that have given rise to specific forms of technophobia.

A few frameworks have been developed to assess technophobia and these are still evolving. The Computer Attitude Scale (CAS) developed by Nickell and Pinto (1986) is a popular model that uses 30 items which present statements of attitudes towards computers and their use. Nickell and Pinto (1986) further classified attitudes towards computers and their usage into three types, namely, anxiety towards computers, liking computers and confidence in one's ability to learn and use computers. This model has been used in several studies such as Kadijevich (2000), Palaigeorgiou et al. (2005) and Selwyn (1997); however, their main focus was on computers.

Rosen et al. (1987) developed the Technophobia Measurement Instrument (TMI) to resonate with the authors' definition of technophobia. The framework measures three separate dimensions: negative attitudes, anxiety, and negative cognition. Heinssen et al. (1987) developed three other different frameworks for each of these dimensions, the General Attitudes Towards Computer Scale (GATCS), the Computer Anxiety Rating Scale (CARS) and the Computer Thoughts Survey (CTS). While these frameworks have been widely adopted and used in several studies such as Aşkar et al. (1992), Chu and Spires (1991), Popovich et al. (2008) and Teo (2008) their main focus was on computerphobia, which is an irrational fear of computers, rather than technophobia, which is an irrational fear of all forms of technologies. Furthermore, many studies have found the GATCS to be unreliable (Aksoy et al., 2020; Anthony et al., 2000; Hogan, 2009). Given that the current study focused on technophobia in the broader sense of the phenomenon, these frameworks that focused on attitudes towards computer usage were not deemed to be appropriate.

The study employed the technophobia assessment framework developed by Khasawneh (2018b) The framework interprets technophobia as a fear, discomfort and anxiety towards various forms of technology. It has five constructs, namely, techno-paranoia, techno-fear, techno-anxiety, cybernetic revolt and communication device avoidance. Given that previous studies have focused on the demographic profile of individuals and their levels of technophobia (Di Giacomo et al., 2020; Hechanova & Dioquino, 2004; Martínez-Córcoles et al., 2017; Nestik et al., 2018), the current study adopted a similar approach by included age, educational level and employment status of the study's respondents.

For the purposes of the study, the framework's constructs were defined in accordance to the definitions provided in Khasawneh (2018b) as follows:

- *Techno-paranoia* is the "unjustified fear and mistrust that an individual forms towards a technology, leading to an avoidance of that technology" (Martínez-Córcoles et al., 2017).

This construct was used to investigate the level of unjustified fear and mistrust towards technology.

- *Techno-fear* is an indicator of an unpleasant feeling of fear that an individual experiences when required to use a technology.
- *Techno-anxiety* is the feeling of apprehension and nervousness that an individual may feel towards the use of a technology. It attests to the level of comfort/discomfort that an individual experiences when using a specific technology
- *Cybernetic Revolt* is a reference to forms of technology that executes automatic control over machines and human existence in general. It consists of human resistance to the pervasive influence on human life of robotics, artificial intelligence, computer networks and sensors that collect and transmit data.
- *Communication Device Avoidance* refers to an individual's reluctance to engage with a technology such as cell phone technology because of the unintended/unpredictable outcomes from the engagement.

The constructs from the Khasawneh (2018b) framework were used as the core components of the questionnaire that was administered to the study's sample. The number of items and reliability levels achieved in the study's data is shown in Table 1.

Table 1: Technophobia Sub-Scale Reliability

Sub-scale dimension	Cronbach Alpha	Items
Techno-paranoia	.916	4
Techno-fear	.915	4
Techno anxiety	.905	4
Cybernetic Revolt	.870	2
Communication Device Avoidance	.943	2

The results show that all the technophobia sub-dimension scales conform with the Cronbach Alpha reliability test (a value of .7 or higher).

4 FINDINGS

The data distribution for the constructs listed in Table 1 did not have a normal distribution. The researcher made use of non-parametric statistical tests to ascertain significant ($p < 0.0$) relationships between the study's variables of interest. As shown in Figure 1 the participants were also categorised by age into young adults (aged 18-35, $N = 127$), middle-aged adults (aged 36-55, $N = 123$) and older adults (56 and older, $N = 134$).

https://doi.org/10.18489/sacj.v34i1.1039

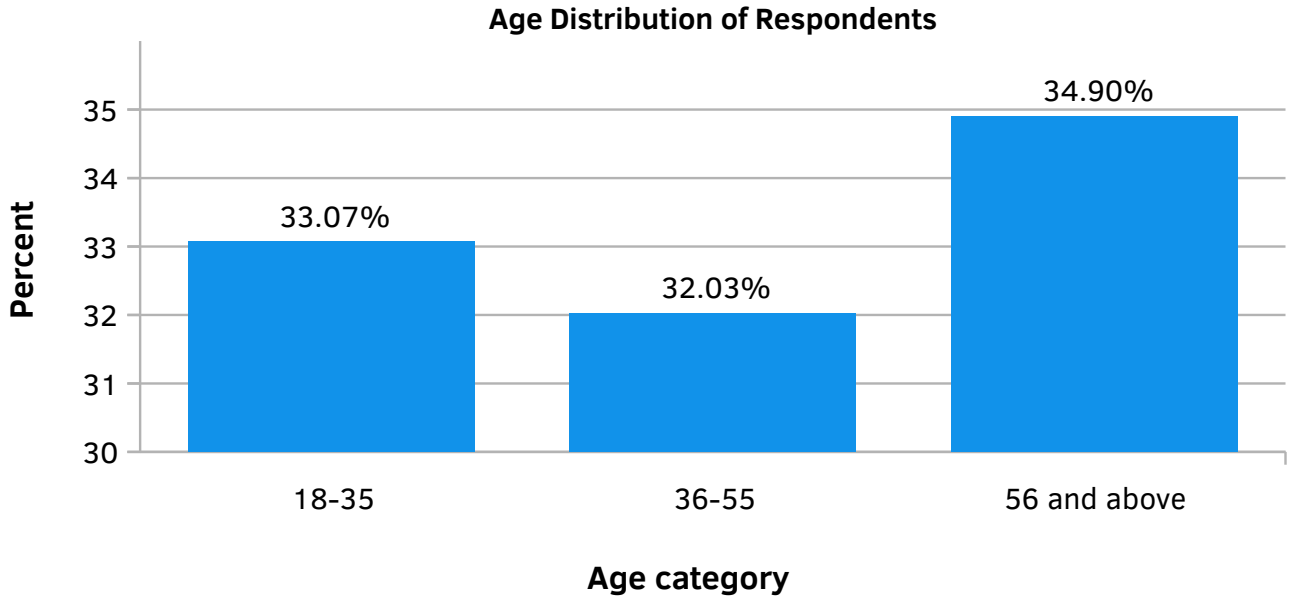

Figure 1: Age distribution of respondents

This age classification was used as an independent variable to determine a relationship with the five constructs of technophobia, namely, techno-paranoia, techno-fear, techno-anxiety, cybernetic revolt and communication device avoidance (CDA).

4.1 Techno-paranoia

The participants were asked questions that focused on a fear that technology would cause irreparable harm and create a dysfunctional society. The analysis revealed that a small percentage (25%, $N = 32$) within the young adult group demonstrated mid to high levels of techno-paranoia, with 35% ($N = 43$) of those within the middle-aged group demonstrating mid- to high-levels of techno-paranoia while the majority (80%, $N = 107$) of the participants within the older adult group demonstrated high levels of paranoia.

A chi-square test of independence showed that there was a significant relationship between age and techno-paranoia ($\chi^2 = 28.32$, $df = 16$, $p = 0.03$). A further analysis revealed that there was a significant relationship between techno-paranoia and the level of education ($\chi^2 = 209.83$, $df = 32$, $p = 0.00$). An observation of the cross-tabulated data indicate that high levels of techno-paranoia are associated with respondents who are not highly qualified and low levels of techno-paranoia are associated with respondents who have higher levels of qualification. The preceding observation is corroborated by the cross-tabulation of the level of education with paranoia as illustrated in Figure 2.

https://doi.org/10.18489/sacj.v34i1.1039

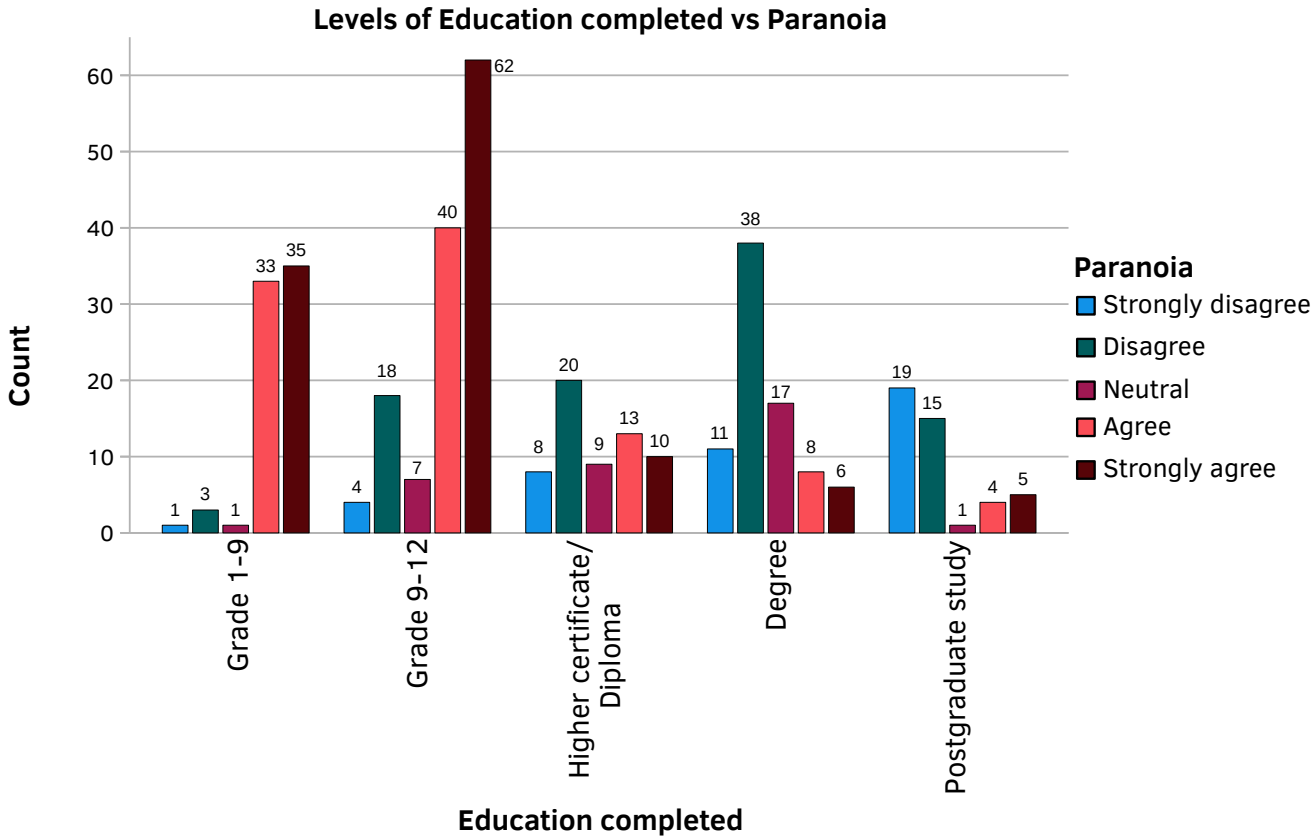

Figure 2: Education and Techno-paranoia

4.2 Techno-fear

A further set of questions were asked that focused on the experience of unpleasant feelings or fear in the presence of technology. It was found that 43% ($N = 55$) of the participants in the young adult group exhibited low to mid-levels of techno-fear; these were mainly participants with low levels of education and informal employment. Within the middle-aged group, 60% ($N = 74$) of the participants with no formal employment and low levels of education demonstrated mid to high levels of techno-fear. Of the 134 participants in the older group, a higher percentage of participants (81%, $N = 109$) demonstrated high levels of techno-fear.

A chi-square test of independence showed that there was a significant relationship between age and techno-fear ($\chi^2 = 23.2$, $df = 8$, $p = 0.02$). A further analysis revealed that there was a significant relationship between techno-fear and the level of education ($\chi^2 = 206.45$, $df = 16$, $p = 0.00$). An observation of the cross-tabulated data indicate that high levels of techno-fear are associated with respondents who are not highly qualified and low lever levels of techno-paranoia are associated with respondents who have higher levels of qualification. The preceding observation is corroborated by the cross-tabulation of the level of education with techno-fear as illustrated in Figure 3.

https://doi.org/10.18489/sacj.v34i1.1039

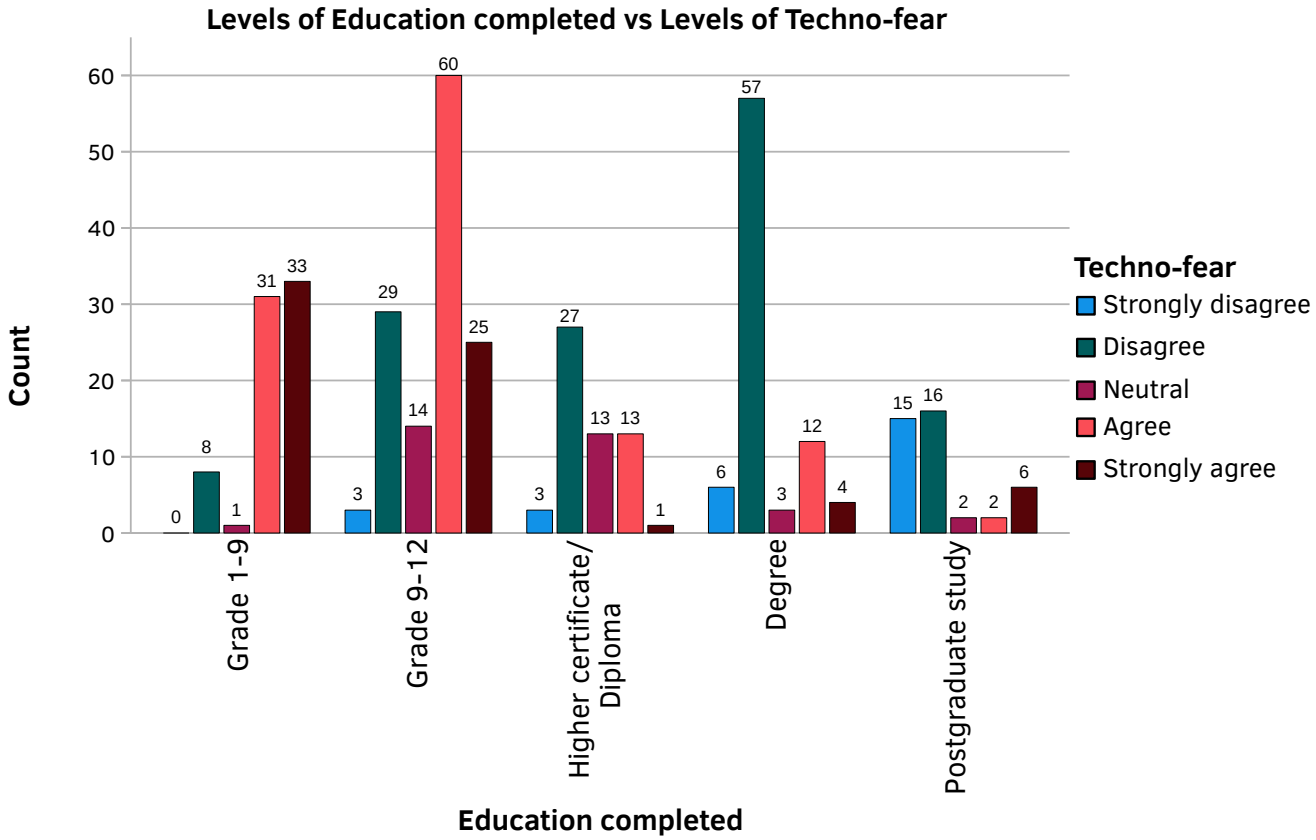

Figure 3: Education and Levels of Techno-fear

4.3 Techno-anxiety

In terms of techno-anxiety, of the 127 participants in the young adult group, only a few (29%, $N = 37$) demonstrated mid- to high-levels of techno-anxiety. A further 57% ($N = 70$) of those in the middle-aged group with a low level of education and no formal employment showed high levels of techno-anxiety, while a high percentage (78%, $N = 105$) of the participants in the older-aged group demonstrated mid to high levels of techno-anxiety.

A chi-square test of independence showed that there was a significant relationship between age and techno-anxiety ($\chi^2 = 18.84$, $df = 8$, $p = 0.02$). A further analysis revealed that there was a significant relationship between techno-anxiety and the level of education ($\chi^2 = 207.58$, $df = 16$, $p = 0.00$). The preceding observation is corroborated by the cross-tabulation of the level of education with techno-anxiety as illustrated in Figure 4.

4.4 Cybernetic Revolt

The survey questions on cybernetic revolt were centred on the notion that computer technology in the form of artificial intelligence and robotics will pose an existential threat to the human

https://doi.org/10.18489/sacj.v34i1.1039

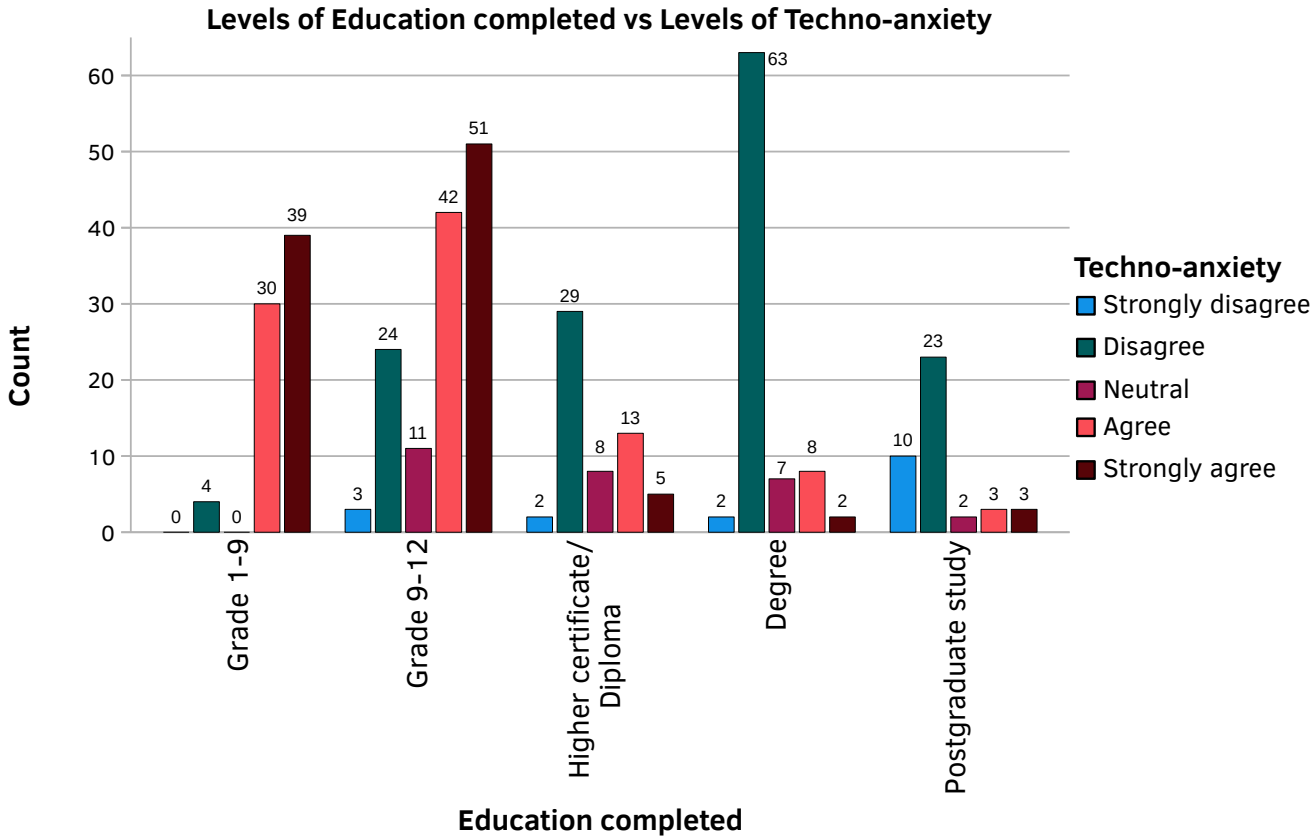

Figure 4: Education and Levels of Techno-anxiety

race. The data analysis revealed that a low percentage (36%, $N = 46$) of participants in the young adult group demonstrated low- to mid-levels of cybernetic revolt, with a higher percentage (66%, $N = 81$) in the middle-aged group exhibiting mid- to high-levels of cybernetic revolt. The majority of the participants (89%, $N = 119$) in the older adult group demonstrated mid- to high levels of cybernetic revolt. A chi-square test of independence showed that there was a significant relationship between age and cybernetic revolt ($\chi^2 = 40.38$, $df = 8$, $p = 0.00$). A further analysis revealed that there was a significant relationship between cybernetic revolt and the level of education ($\chi^2 = 104.54$, $df = 16$, $p = 0.00$). An observation of the cross-tabulated data indicate that high levels of cybernetic revolt are associated with respondents who are not highly qualified and low levels of cybernetic revolt are associated with respondents who have higher levels of qualification. The preceding observation is corroborated by the cross-tabulation of the level of education with cybernetic revolt as illustrated in Figure 5.

https://doi.org/10.18489/sacj.v34i1.1039

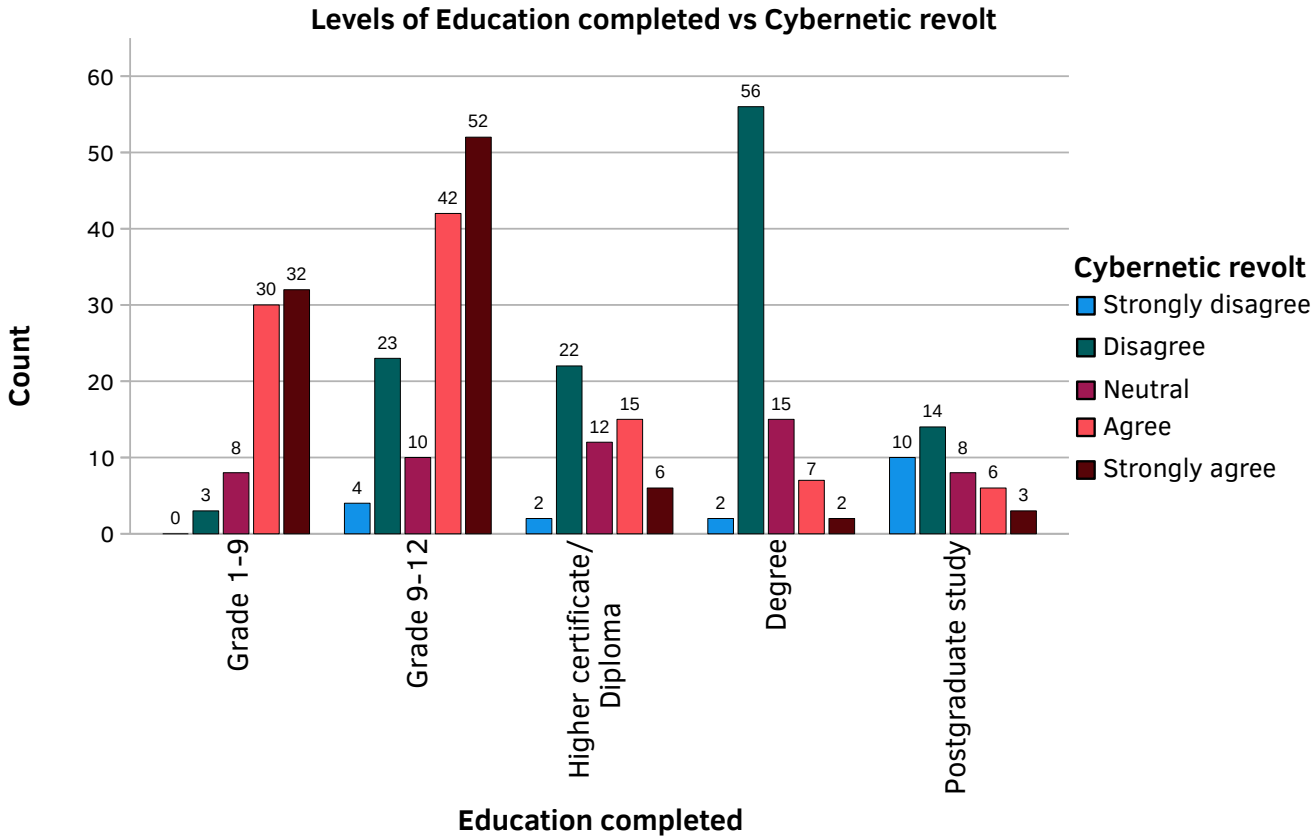

Figure 5: Education and Cybernetic Revolt

4.5 Communication Device Avoidance (CDA)

This section of the questionnaire was aimed at establishing human behaviour towards the use of communication devices such as cell phones. The section of the questionnaire consisted of 2 questionnaire items that did include a reference to a cell phone as an example of CDA from the perspective of not knowing the consequence of using such a technology for routine tasks. A high percentage (78%, $N = 105$) of the participants in the older age group demonstrated mid- to high levels of CDA, while the middle-aged group had a lower percentage (59%, N = 73) who demonstrated CDA. From the young adult group, there was also a lower percentage (31%, N = 39) who demonstrated CDA. A chi-square test of independence showed that there was a significant relationship between age and CDA ($\chi^2 = 57.8$, $df = 8$, $p = 0.00$). An observation of the cross-tabulated data indicates that high levels of CDA are associated with respondents who were classified as older adults. A further analysis revealed that there was a significant relationship between CDA and the level of education ($\chi^2 = 148.70$, $df = 16$, $p = 0.00$) The preceding observation is corroborated by the cross tabulation of the level of education with CDA as illustrated in Figure 6.

https://doi.org/10.18489/sacj.v34i1.1039

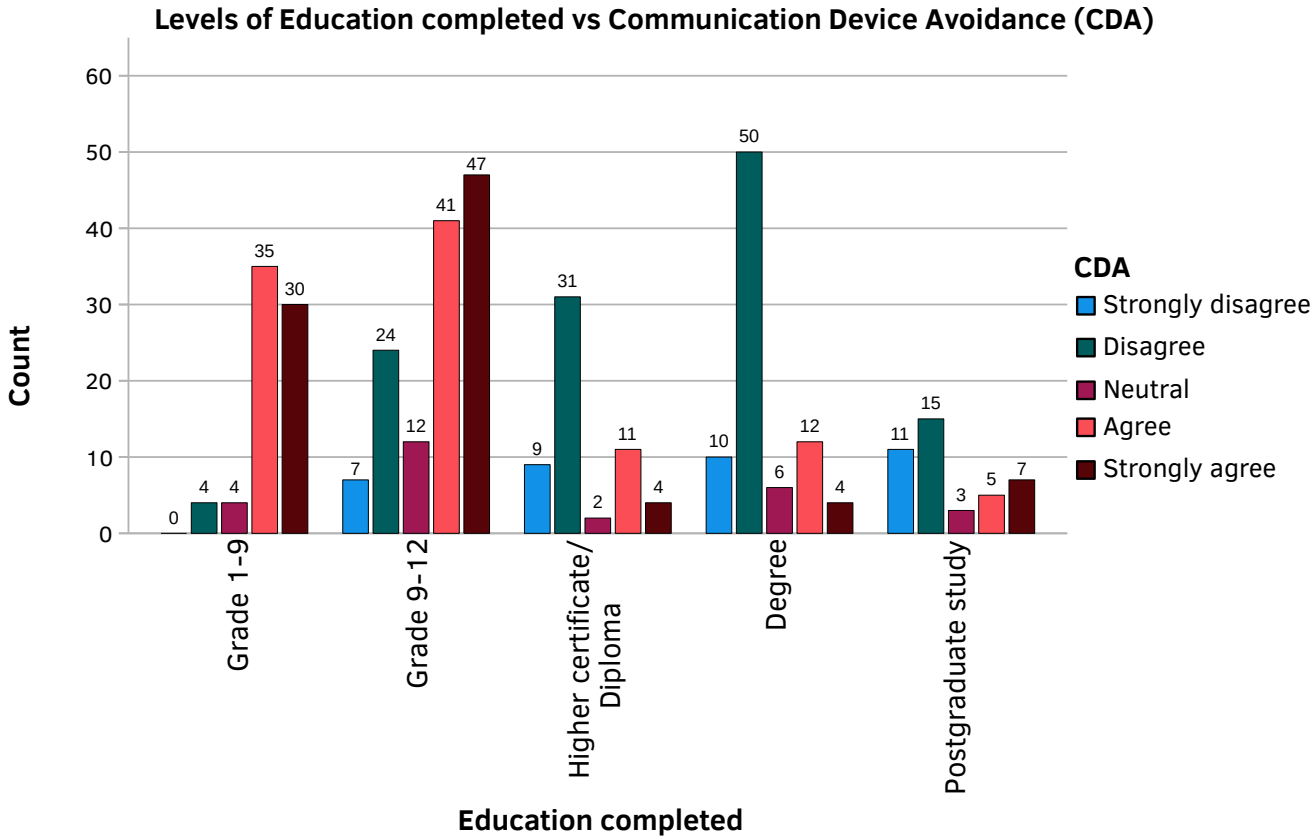

Figure 6: Education and CDA

4.6 Cross tabulation of Technophobia and Employment Status

The concept of technophobia has been decomposed into the 5 constructs of techno-paranoia, techno-fear, techno-anxiety, cybernetic revolt and CDA, each of which has been subjected to an empirical analysis in the preceding sections. A series of chi-square tests of independence between each of these constructs and the employment status of the respondents has yielded a significant relationship in all instances. This outcome has been explored further by creating bar plots of the means of each construct against the employment status of the respondents. The resulting visualisation in Figure 7 shows a pattern of lower levels of technophobia that is displayed by respondents who are formally employed while there are higher levels of technophobia displayed by respondents who are employed in the informal sector, self-employed or unemployed.

4.7 Cross tabulation of Technophobia and Race

A series of chi-square tests of independence between each of the constructs of technophobia and the race of the respondents has yielded a significant relationship in 3 of the constructs. The

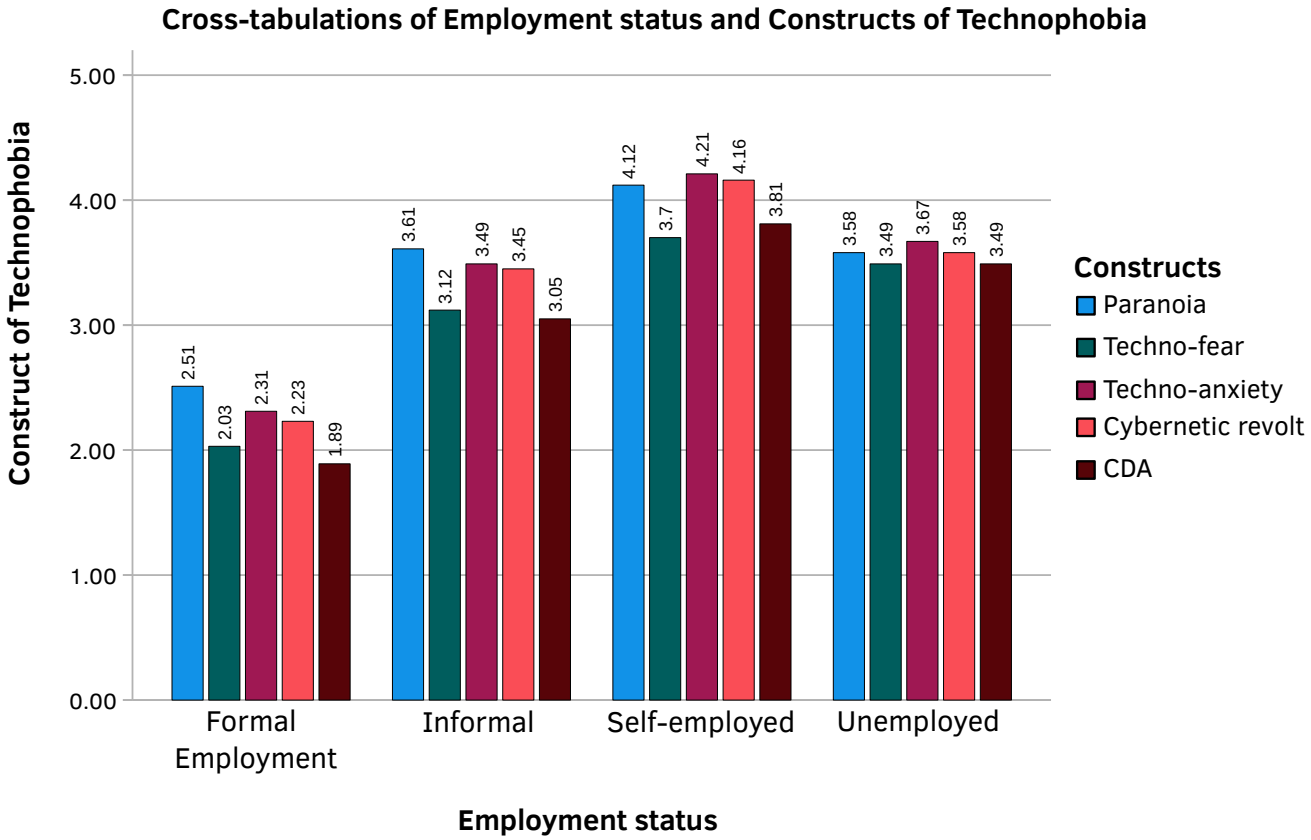

Figure 7: Employment Status and Levels of Technophobia

chi-squared test of independence showed a significant relationship between techno-paranoia ($\chi^2 = 45.76$, $df = 12$, $p = 0.00$), techno-anxiety ($\chi^2 = 21.31$, $df = 12$, $p = 0.04$), cybernetic revolt ($\chi^2 = 26.49$, $df = 12$, $p = 0.01$) and the race of the respondent. However, techno-fear and CDA did not have a significant relationship with the race of the respondent. In order to obtain a clearer picture of the overall role played by race and the combined constructs of technophobia, bar plots of the means of each construct were cross tabulated with the race of the respondents, resulting in the visualisation shown in Figure 8. From this figure it can be established that levels of technophobia are in general higher amongst the non-white respondents.

5 DISCUSSION

The study's results depict significant differences in the overall level of technophobia among the age groups (young, middle-aged, and older adults). This aligns with the findings of previous studies (Brosnan, 1998; Di Giacomo et al., 2020; Nimrod, 2018) that showed positive correlation between age and levels of technophobia. However, the results contrast with studies (Anthony et al., 2000; Hogan, 2006; Rosen & Weil, 1995) that concluded that older adults

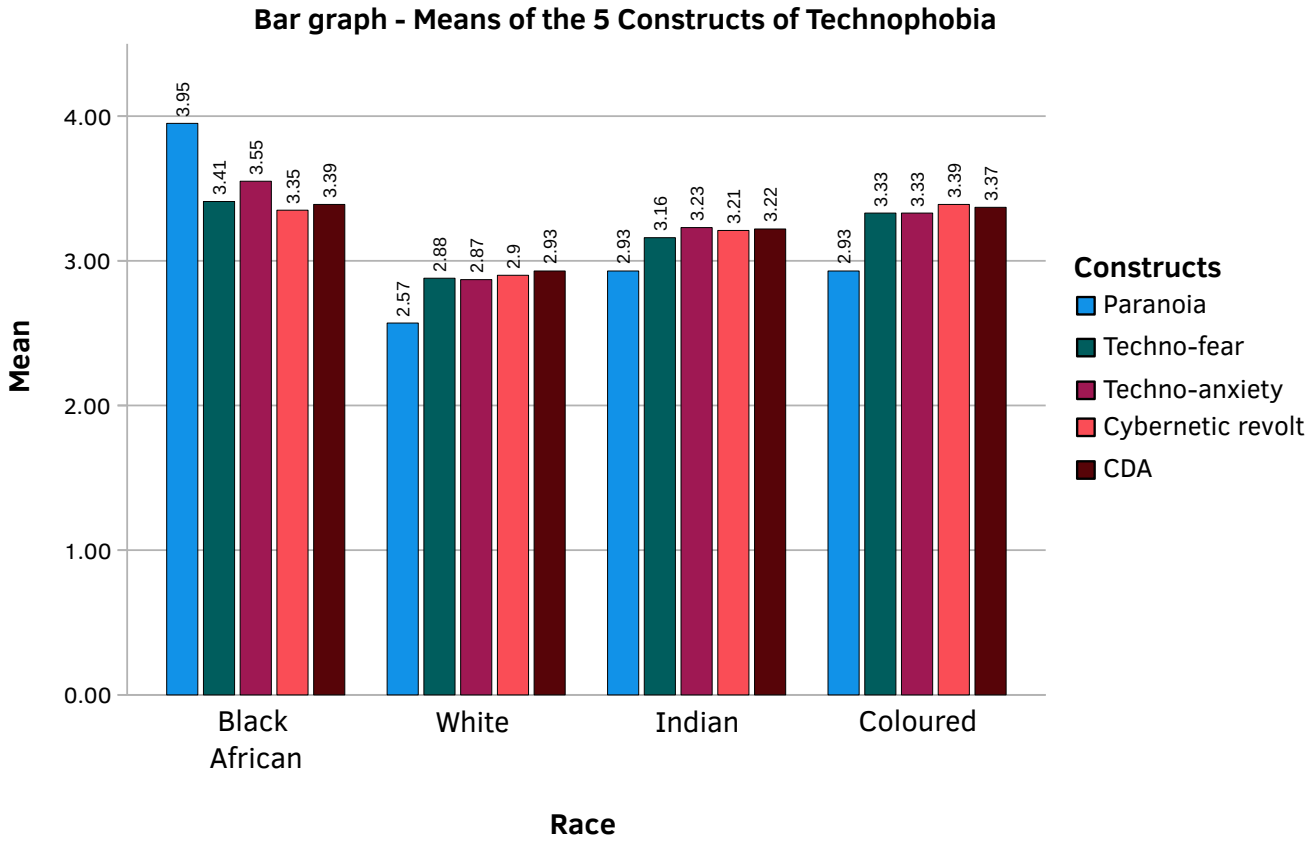

Figure 8: Race and Levels of Technophobia

are prone to high levels of technophobia.

All the constructs that underpin this study were shown to have a significant relationship with age, education and employment level. However, techno-fear and CDA did not have a significant relationship with the race of the respondents. It was also observed that level of education and employment status were positively correlated with the level of technophobia among all age groups. Other studies have also established positive correlation between educational level, employment level and technophobia levels (Khasawneh, 2018b; Nimrod, 2018). The finding that people with high levels of education showed lower signs of technophobia can be attributed to the participants' prior exposure to technologies that has been found to be associated with low computer anxiety and low technophobia levels (Awofala et al., 2019; Oyadeyi, 2018) Individuals who have been exposed to technology are likely to have developed strong affinity with technologies, often resulting in high confidence and competency levels, and also leading to decreased anxiety and technophobia(Di Giacomo et al., 2020; Sigit, 2021; Tsai et al., 2020).

Participants with no formal education demonstrated high levels of technophobia, although mid-level technophobia was observed among participants in the young adult group. The mid-

level technophobia observed for young adults with no formal education can be attributed to exposure in the current digital era. Furthermore, young adults are believed to be more technically savvy than their older counterparts (Awofala et al., 2019) The majority of older adults are likely to have only encountered technology later in life; they thus have less affinity with it and are often challenged by technology (Adjin-Tettey, 2020). This leads to negative attitudes and anxiety, which are regarded as the antecedents of technophobia (Khasawneh, 2018b; Lee et al., 2019; Sigit, 2021).

Employment status was also found to be positively correlated with technophobia ($p < 0.05$) in this study. Participants with formal employment demonstrated low levels of technophobia while those in informal employment or self-employed demonstrated high levels. These findings support those of previous studies by Khasawneh (2018b), Nimrod (2018) and Oyadeyi (2018). People in formal employment are more likely to have access to technologies than those in informal jobs. Moreover, they will usually gain exposure to various forms of technologies in the course of their career, boosting their confidence and competence, which often results in less anxiety than those with no exposure. Factors such as income level also influence access to technology. Given the high unemployment rate in South Africa, many people will be unable to invest in technology (Foko et al., 2017; Santos et al., 2017).

However, the majority of the participants of the white race demonstrated lower levels of technophobia in comparison to the non-white respondents. This can be attributed to socio-economic disparities during the apartheid era where race and geographic location determined access to technological infrastructure, opportunities, and education (Makhado & Tshisikhawe, 2020). This resulted in unequal access to technology and employment opportunities amongst individuals of different races, with the privileged white monitory enjoying the best access.

6 CONCLUSIONS

In conclusion, based on the study's results, technophobia is observed within all age groups. However, the young adult group with no formal education demonstrated lower levels of technophobia than other groups with no formal education or employment. The chi-square test showed a significant relationship between levels of technophobia and the demographic profile of the study's respondents (age, race, employment and education).

After summarizing implications of our studies' findings, we make some recommendations for managing technophobia. We end with limitations and suggestions for future work.

6.1 Implication of the study's findings

The study has established significant correlations between the demographic profile of respondents and levels of technophobia. These profile attributes provide an indicator that the levels of technophobia in South Africa are divided along the attributes of age, race, qualification levels and employment status. While the characteristics of age and race cannot be controlled, South

African government in general and the Department of Basic Education need to take responsibility the variations in the employment status and the levels of education of South African citizens. From the inception of South Africa liberation from an apartheid government to a democratic one, the South African government has been committed to integrating all citizens into the information society. Several initiatives have been launched to address technophobia, particularly among the Black African racial grouping and the older adults. This involves skills acquisition, provision of technological infrastructure and resources (Cox et al., 2018; Jantjies, 2020). Non-profit organisations that serve older adults have also constructed strategies to ensure that their information needs are met (Lavery et al., 2018; Lewis, 2020). Current studies have focused on identifying and studying how technology related interventions are being employed to bridge the digital divide (Lembani et al., 2020; Nyahodza & Higgs, 2017). However, technophobia remains a major issue in South Africa, limiting technology adoption. Therefore, the findings obtained in the study serve as empirical evidence that may be used to inform initiatives by the South African government to integrate all citizens into the information society and bridge the digital divide.

Findings obtained from this study demonstrate how a lack of education and employment influences negative attitudes in individuals and aggravate anxiety which in turn leads to total avoidance of technology. The adoption of technology depends on the availability of infrastructures and resources as well as on attitude of the potential users. If potential users hold negative attitudes and anxieties about specific technology, they are less likely to adopt those technologies. Given the correlation between technophobia, educational level, race and employment status established in this study, it is important that strategies are devised and employed by government and related entities to enable the envisioned information society for South Africa. This should include initiatives that effect a reduction in the unemployment across all age groups coupled with a strategy to improve the levels of qualification of general citizens in the country. Aligned to the educational imperative, the Department of Basic Education should invest in strategies that focus on the integration of technology-based subjects at the basic education level.

Contrary to previous studies that indicated that technophobia mainly existed among the older aged groups, 55 years and older, this finding instead found that technophobia does exist within all age groups, albeit at a marginally lower level with younger adults. As such, intervention strategies should thus focus on all age groups within all societies.

6.2 Managing Technophobia

Given the on-going integration of information technology in all aspects of daily life, it is crucial that individuals, irrespective of age, be able and willing to use it. Technology is considered as an essential tool to enhance one's quality of life, particularly for older adults. For instance, adults can use the Internet for shopping, leisure, and most importantly, health-related purposes. However, people with a strong aversion to technologies are unlikely to use them and are thus at a disadvantage. Based on the study's findings, it is recommended that anxiety

reduction programmes be instituted in the form of training in technological literacy. This is based on the notion that lack of experience (or exposure) that often results in high anxiety and negative attitudes (Brosnan, 1998). Sigit (2021)'s study found that teachers with little computer experience demonstrated mid-level anxiety within the first 30 hours of instruction, but their anxiety diminished after additional hours of training. Targeted skills development programmes which focus on computer self-efficacy could also be organised for anxious and cognitive technophobes, and uncomfortable users.

6.3 Limitations and Suggestions for future research

While the use of a survey-based approach for data collection increases the chance of a high response rate, this method prevented the researcher from probing participants' responses in order to gain a deeper insight into the phenomenon of technophobia. Also, the current report from this study did not include gender as a contributing demographic to the issue of technophobia and this is recommended for a study with a larger scope. The empirical basis for the study was restricted to a single province in the country, and ideally, this should be extended to the other 8 provinces. It is thus suggested that future studies should be conducted on a broader scope and cover a more diverse population to determine whether the findings are consistent with the restricted sample that the current study has been confined to.

References

Adjin-Tettey, T. D. (2020). Can 'digital natives' be 'strangers' to digital technologies? An analytical reflection. *Inkanyiso: Journal of Humanities and Social Sciences*, *12*(1), 11–23. https://www.ajol.info/index.php/ijhss/article/view/199513

Ajzen, I. & Cote, N. G. (2008). Attitudes and the prediction of behavior. In W. D. Crano & R. Prislin (Eds.), *Attitudes and attitude change*. New York: Psychology Press.

Aksoy, N. C., Alan, A. K., Kabadayi, E. T. & Aksoy, A. (2020). Individuals' intention to use sports wearables: The moderating role of technophobia. *International Journal of Sports Marketing and Sponsorship*, *21*(2), 225–245. https://doi.org/10.1108/IJSMS-08-2019-0083

Anderson, O. (2011). *A survey of gender differences in technophobia and in the adoption of high-technology consumer products* (Masters Thesis). https://repository.up.ac.za/bitstream/handle/2263/24407/dissertation.pdf?sequence=1

Anthony, L., Clarke, M. & Anderson, S. (2000). Technophobia and personality subtypes in a sample of South African university students. *Computers in Human Behavior*, *16*(1), 31–44. https://doi.org/10.1016/S0747-5632(99)00050-3

Aşkar, P., Yavuz, H. & Köksal, M. (1992). Students' perceptions of computer assisted instruction environment and their attitudes towards computer assisted learning. *Educational Research*, *34*(2), 133–139. https://doi.org/10.1080/0013188920340204

Awofala, A. O., Olabiyi, O. S., Awofala, A. A., Arigbabu, A. A., Fatade, A. O. & Udeani, U. N. (2019). Attitudes toward computer, computer anxiety and gender as determinants of pre-service science, technology, and mathematics teachers' computer self-efficacy. *Digital Education Review*, (36), 51–67. https://doi.org/10.1344/der.2019.36.51-67

Blignaut, P., Burger, A., McDonald, T. & Tolmie, J. (2009). Computer attitude and anxiety. *Encyclopedia of information science and technology* (2nd, pp. 647–653). IGI Global. https://www.researchgate.net/publication/243444412_Computer_Attitude_and_Anxiety

Bornman, E. (2016). Information society and digital divide in South Africa: Results of longitudinal surveys. *Information, Communication & Society*, *19*(2), 264–278. https://doi.org/10.1080/1369118X.2015.1065285

Bozionelos, N. (2001). Computer anxiety: Relationship with computer experience and prevalence. *Computers in human behavior*, *17*(2), 213–224. https://doi.org/10.1016/S0747-5632(00)00039-X

Brand, R. & Fischer, J. (2013). Overcoming the technophilia/technophobia split in environmental discourse. *Environmental Politics*, *22*(2), 235–254. https://doi.org/10.1080/09644016.2012.730264

Brosnan, M. J. (1998). *Technophobia: The psychological impact of information technology*. Routledge.

Cai, Z., Fan, X. & Du, J. (2017). Gender and attitudes toward technology use: A meta-analysis. *Computers & Education*, *105*, 1–13. https://doi.org/10.1016/j.compedu.2016.11.003

Charles, M. (2020). Gender attitudes in Africa: Liberal egalitarianism across 34 countries. *Social Forces*, *99*(1), 86–125. https://doi.org/10.1093/sf/soz132

Chu, P. & Spires, E. E. (1991). Validating the computer anxiety rating scale: Effects of cognitive style and computer courses on computer anxiety. *Computers in Human Behavior*, *7*(1-2), 7–21. https://doi.org/10.1016/0747-5632(91)90025-V

Clarke, M. (2000). Technological experience and technophobia in South African university students. *South African Computer Journal*, (25), 3–17.

Cox, M., Cheng, L. & Forbes, A. (2018). Bridging the digital divide: A South African perspective. *Advanced Photonics 2018 (BGPP, IPR, NP, NOMA, Sensors, Networks, SPPCom, SOF)*. https://doi.org/10.1364/NETWORKS.2018.NeW2F.3

Crabbe, S. J. (2018). *Computer anxiety: The development of tools to measure severity and type, and offer appropriate mitigation strategies* (PhD Thesis). https://theses.ncl.ac.uk/jspui/bitstream/10443/4382/1/Crabbe%20S%202018.pdf

Di Giacomo, D., Guerra, F., Perilli, E. & Ranieri, J. (2020). Technophobia as emerging risk factor in aging: Investigation on computer anxiety dimension. *Health Psychology Research*, *8*(1). https://doi.org/10.4081/hpr.2020.8207

Di Giacomo, D., Ranieri, J., D'Amico, M., Guerra, F. & Passafiume, D. (2019). Psychological barriers to digital living in older adults: Computer anxiety as predictive mechanism for technophobia. *Behavioral Sciences*, *9*(9). https://doi.org/10.3390/bs9090096

Dinello, D. (2006). *Technophobia: Science fiction visions of posthuman technology*. Austin, Texas: University of Texas Press.

Dos Santos, T. D. & de Santana, V. F. (2018). Computer anxiety and interaction: A systematic review. *Proceedings of the 15th International Web for All Conference*, 1–10. https://doi.org/10.1145/3192714.3192825

Dyck, J. L., Gee, N. R. & Smither, J. A.-A. (1998). The changing construct of computer anxiety for younger and older adults. *Computers in human behavior*, *14*(1), 61–77. https://doi.org/10.1016/S0747-5632(97)00032-0

Epstein, S. (1985). Anxiety, arousal, and the self-concept. *Issues in mental health nursing*, *7*(1-4), 265–305. https://doi.org/10.3109/01612848509009458

Faloye, S., Ranjeeth, S. & Ako-Nai, S. (2022). Impact of technophobia on the digital divide. A preliminary case study in the Eastern Cape province of South Africa [in press]. *Proceedings of IST-Africa 2022 Conference*. https://www.researchgate.net/publication/360862315_Impact_of_Technophobia_on_the_Digital_Divide_A_Preliminary_Case_Study_in_the_Eastern_Cape_Province_of_South_Africa

Faloye, S. T. & Ajayi, N. (2021). Understanding the impact of the digital divide on South African students in higher educational institutions. *African Journal of Science, Technology, Innovation and Development*. https://doi.org/10.1080/20421338.2021.1983118

Faloye, S. T., Ajayi, N. A. & Raghavjee, R. (2020). Managing the challenges of the digital divide among first year students: A case of UKZN. *2020 IST-Africa Conference (IST-Africa)*, 1–11.

Farhan, R., Latifa, R., Idriyani, N., Layyinah, Subchi, I. & Saepudin Jahar, A. (2020). Assessing computer anxiety in vocational high-school students. *2020 8th International Conference on Cyber and IT Service Management (CITSM)*, 1–4. https://doi.org/10.1109/CITSM50537.2020.9268815

Foko, T., Thulare, T., Legare, L. & Maremi, K. (2017). Information and communication technology platforms deployment: Technology access reaches South African rural areas. *2017 IST-Africa Week Conference (IST-Africa)*, 1–9. https://doi.org/10.23919/ISTAFRICA.2017.8102300

Hechanova, R. M. & Dioquino, M. C., Jr. (2004). Technophobia and the Filipino worker. *Philippine Journal of Psychology*, *37*(2), 101–119.

Heinssen, R. K., Jr, Glass, C. R. & Knight, L. A. (1987). Assessing computer anxiety: Development and validation of the computer anxiety rating scale. *Computers in human behavior*, *3*(1), 49–59. https://doi.org/10.1016/0747-5632(87)90010-0

Hogan, M. (2006). Technophobia amongst older adults in Ireland. *Irish Journal of Management*, *27*(1), 57–77.

Hogan, M. (2009). Age differences in technophobia: An Irish study. *Information systems development: Challenges in practice, theory* (pp. 117–130). Springer. https://doi.org/10.1007/978-0-387-68772-8_10

Jantjies, M. (2020). How South Africa can address digital inequalities in e-learning [Accessed: 5 July 2022]. https://theconversation.com/how-south-africa-can-address-digital-inequalities-in-e-learning-137086

Jeong, C. H. (2001). Gender differences in computer attitudes: New evidence from Korea. *International Review of Public Administration*, *6*(2), 115–123. https://doi.org/10.1080/12294659.2001.10804985

Kadijevich, D. (2000). Gender differences in computer attitude among ninth-grade students. *Journal of Educational Computing Research*, *22*(2), 145–154.

Kamberidou, I. & Patsantaras, N. (2004). The "virtual harem": Technophobia or exclusion? An educational perspective. *Consultation Workshop on Gender and Technology*. http://scholar.uoa.gr/ikamper/publications/%E2%80%9Cvirtual-harem%E2%80%9D-technophobia-or-exclusion-educational-perspective

Kennedy, O. (2018). Examining student perceptions about smartphones to understand lack of acceptance of mobile-assisted language learning. *Future-proof CALL: Language learning as exploration and encounters–short papers from EUROCALL*, 137–141.

Khasawneh, O. Y. (2018a). Technophobia without boarders: The influence of technophobia and emotional intelligence on technology acceptance and the moderating influence of organizational climate. *Computers in Human Behavior*, *88*, 210–218. https://doi.org/10.1016/j.chb.2018.07.007

Khasawneh, O. Y. (2018b). Technophobia: Examining its hidden factors and defining it. *Technology in Society*, *54*, 93–100. https://doi.org/10.1016/j.techsoc.2018.03.008

Khululwa, S. & Newlin, M. (2018). Technophobia: Understanding computer anxiety for teaching and learning of computer studies. *Journal of Communication*, *9*(1,2), 11–23. https://doi.org/10.31901/24566586.2018/09.1-2.231

Kotze, T. G., Anderson, O. & Summerfield, K. (2012). Technophobia: Gender differences in the adoption of high-technology consumer products. *South African Journal of Business Management*, *47*(1), 21–28. https://doi.org/10.4102/sajbm.v47i1.49

Krejcie, R. V. & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and psychological measurement*, *30*(3), 607–610. https://doi.org/10.1177%2F001316447003000308

Lavery, M. P. J., Abadi, M. M., Bauer, R., Brambilla, G., Cheng, L., Cox, M. A., Dudley, A., Ellis, A. D., Fontaine, N. K., Kelly, A. E., Marquardt, C., Matlhane, S., Ndagano, B., Petruccione, F., Slavík, R., Romanato, F., Rosales-Guzmán, C., Roux, F. S., Roux, K., … Forbes, A. (2018). Tackling Africa's digital divide. *Nature Photonics*, *12*(5), 249–252. https://doi.org/10.1038/s41566-018-0162-z

Lee, C. C., Czaja, S. J., Moxley, J. H., Sharit, J., Boot, W. R., Charness, N. & Rogers, W. A. (2019). Attitudes toward computers across adulthood from 1994 to 2013. *The Gerontologist*, *59*(1), 22–33. https://doi.org/10.1093/geront/gny081

Lembani, R., Gunter, A., Breines, M. & Dalu, M. T. B. (2020). The same course, different access: The digital divide between urban and rural distance education students in South Africa. *Journal of Geography in Higher Education*, *44*(1), 70–84. https://doi.org/10.1080/03098265.2019.1694876

Lewis, C. (2020). The digital donga. *Regulating telecommunications in South Africa* (pp. 1–22). Springer. https://doi.org/10.1007/978-3-030-43527-1_1

Loyd, B. H. & Gressard, C. (1984). The effects of sex, age, and computer experience on computer attitudes. *AEDS journal*, *18*(2), 67–77. https://doi.org/10.1080/00011037.1984.11008387

Makhado, M. P. & Tshisikhawe, T. R. (2020). How apartheid education encouraged and reinforced tribalism and xenophobia in South Africa. *Impact of immigration and xenophobia on development in Africa* (pp. 131–151). IGI Global.

Martínez-Córcoles, M., Teichmann, M. & Murdvee, M. (2017). Assessing technophobia and technophilia: Development and validation of a questionnaire. *Technology in Society*, *51*, 183–188. https://doi.org/10.1016/j.techsoc.2017.09.007

Mcilroy, D., Sadler, C. & Boojawon, N. (2007). Computer phobia and computer self-efficacy: Their association with undergraduates' use of university computer facilities. *Computers in Human Behavior*, *23*(3), 1285–1299. https://doi.org/10.1016/j.chb.2004.12.004

Nestik, T., Zhuravlev, A., Eduard, P., Marianna, S. C., Lioudmila, B., Piurcosky, F. P. & Ferreira, J. V. (2018). Technophobia as a cultural and psychological phenomenon: Theoretical analysis. *Interação-Revista De Ensino, Pesquisa E Extensão*, *20*(1), 266–281. https://doi.org/10.33836/interacao.v20i1.191

Nickell, G. S. & Pinto, J. N. (1986). The computer attitude scale. *Computers in human behavior*, *2*(4), 301–306. https://doi.org/10.1016/0747-5632(86)90010-5

Nimrod, G. (2018). Technophobia among older Internet users. *Educational Gerontology*, *44*(2-3), 148–162. https://doi.org/10.1080/03601277.2018.1428145

Nimrod, G. (2021). Not good days for technophobes: Older internet users during the COVID-19 pandemic. *Educational Gerontology*, *47*(4), 160–171. https://doi.org/10.1080/03601277.2021.1894530

Nyahodza, L. & Higgs, R. (2017). Towards bridging the digital divide in post-apartheid South Africa: A case of a historically disadvantaged university in cape town. *South African Journal of Libraries and Information Science*, *83*(1), 39–48. https://doi.org/10.7553/83-1-1645

Oyadeyi, J. B. (2018). An assessment of computer anxiety among distance learning freshmen in South Western Nigeria. *KIU Journal of Social Sciences*, *4*(2), 151–159.

Palaigeorgiou, G., Siozos, P., Konstantakis, N. I. & Tsoukalas, I. A. (2005). A computer attitude scale for computer science freshmen and its educational implications. *Journal of computer assisted learning*, *21*(5), 330–342. https://doi.org/10.1111/j.1365-2729.2005.00137.x

Popovich, P. M., Gullekson, N., Morris, S. & Morse, B. (2008). Comparing attitudes towards computer usage by undergraduates from 1986 to 2005. *Computers in Human Behavior*, *24*(3), 986–992. https://doi.org/10.1016/j.chb.2007.03.002

Powell, A. L. (2013). Computer anxiety: Comparison of research from the 1990s and 2000s. *Computers in Human Behavior*, *29*(6), 2337–2381. https://doi.org/10.1016/j.chb.2013.05.012

Raub, A. C. (1981). *Correlates of computer anxiety in college students* (PhD Thesis). https://www.proquest.com/docview/303158028

Romero Martínez, S. J., Ordóñez Camacho, X. G., Guillén-Gamez, F. D. & Bravo Agapito, J. (2020). Attitudes toward technology among distance education students: Validation of an explanatory model. *Online Learning*, *24*(2), 59–75.

Rosen, L. D., Sears, D. C. & Weil, M. M. (1987). Computerphobia. *Behavior Research Methods, Instruments, & Computers*, *19*(2), 167–179. https://doi.org/10.3758/BF03203781

Rosen, L. D. & Weil, M. M. (1995). Computer availability, computer experience and technophobia among public school teachers. *Computers in human behavior*, *11*(1), 9–31. https://doi.org/10.1016/0747-5632(94)00018-D

Santos, M., Sequeira, T. N. & Ferreira-Lopes, A. (2017). Income inequality and technological adoption. *Journal of Economic Issues*, *51*(4), 979–1000. https://doi.org/10.1080/00213624.2017.1391582

Schlebusch, C. L. (2018). Computer anxiety, computer self-efficacy and attitudes towards the internet of first year students at a South African university of technology. *Africa Education Review*, *15*(3), 72–90. https://doi.org/10.1080/18146627.2017.1341291

Selwyn, N. (1997). Students' attitudes toward computers: Validation of a computer attitude scale for 16–19 education. *Computers & Education*, *28*(1), 35–1.

Sigit, H. (2021). The effect of computer anxiety, computer attitude, computer self efficacy and accounting knowledge on accounting students' understanding using accurate-based accounting software. *Proceedings of 2nd Annual Management, Business and Economic Conference (AMBEC 2020)*, 50–54. https://doi.org/10.2991/aebmr.k.210717.011

Singh, N., Chandwani, S., Singh, J. & Kumar, D. (2019). Exploration of level of computer anxiety among veterinary students of Punjab. *Library Philosophy and Practice (e-journal)*. https://digitalcommons.unl.edu/libphilprac/3014/

Svenningsson, J., Höst, G., Hultén, M. & Hallström, J. (2021). Students' attitudes toward technology: Exploring the relationship among affective, cognitive and behavioral components of the attitude construct. *International Journal of Technology and Design Education*, 1531–1551. https://doi.org/10.1007/s10798-021-09657-7

Teo, T. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey. *Australasian Journal of Educational Technology*, *24*(4), 413–424. https://doi.org/10.14742/ajet.1201

Tsai, T.-H., Lin, W.-Y., Chang, Y.-S., Chang, P.-C. & Lee, M.-Y. (2020). Technology anxiety and resistance to change behavioral study of a wearable cardiac warming system using an extended TAM for older adults. *PLOS ONE*, *15*(1), e0227270. https://doi.org/10.1371/journal.pone.0227270