The Impact of Electronic Devices During the COVID-19 Pandemic on Grade 2 Learners' Socio-Cognitive Development

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DEDICATION

To all of the learners, parents and teachers affected by the COVID-19 pandemic.

ABSTRACT

The COVID-19 pandemic has led to an increased usage of electronic devices by learners, due to virtual classrooms and devices used for entertainment, which may impact the socio-cognitive development of learners. Previous studies done mainly outside of South Africa show mixed results: Electronic devices are beneficial to a certain extent but have detrimental effects on learners' social behaviour and cognitive abilities. The impact of electronic devices on the socio-cognitive development of learners has not yet received adequate attention from researchers within South Africa. This study aims to explore the impact of electronic devices during COVID-19 on the socio-cognitive development of Grade 2 learners. The location of the research is in a preparatory school (Grades 1 to 3) in the Eastern Cape province, South Africa. The quantitative research design used three questionnaires (screen time, social development, and cognitive development) participated in by parents, teachers and learners respectively, framed by Bandura's Social Cognitive Theory. The findings of the study showed that online learning and school closures severely impacted the socio-cognitive development of learners, and that they were not at the expected developmental level for their age group. Screen time increased significantly. However, the different levels of electronic device usage by learners had no significant impact on development. The COVID-19 pandemic, school closures, and online learning had a detrimental effect on the socio-cognitive development of the learners. Intervention should be done to address the underdeveloped socio-cognitive skills of learners.

Keywords: cognitive development, COVID-19 pandemic, electronic devices, National Lockdown, social development,

RESEARCH JOURNEY

Writing this dissertation has been a journey of more than eighteen months. My research topic was picked quite easily – the COVID-19 pandemic quarantined teachers and learners at home and schooling was done online. I noted that the lockdown and online learning increased my own screen time and I wondered if the same was happening to learners. This inspired me to read more about the impact of electronic devices on the development of learners i.e. the social, cognitive, emotional, and physical development.

The number of studies done on this topic overseas was astounding and I realised that I would have to narrow it down to social and cognitive development only. The proposal chapter, title registration and the literature review chapter were the most daunting part of the process, which took ten months to complete. By the time my methodology chapter and instruments were ready to be used in the data collection, the Grade 2 learners had progressed to Grade 3. This prompted me to adapt the instruments to include certain concepts taught in Grade 3, while the rest of the questions remained relevant to Grade 2's (eight-year-olds). The data collection process went smoothly and then it was time to analyse the data to see if the pandemic and increased screen time had impacted the socio-cognitive development of the learners.

Before I knew it, I was busy writing study conclusions and recommendations for future research – some of which I am considering undertaking myself. This whole process has been an amazing journey with many challenges and triumphs – and in the end, it was all worth it!

LIST OF ACRONYMS

Acronym	Definition
3-D	Three Dimensional Shapes
AAP	American Academy of Paediatrics
ABC	American broadcast network
ACP	The American College of Paediatricians
ADHD	Attention-deficit/hyperactivity disorder
ANOVA	Analysis of variance
CAPS	Curriculum and Assessment Policy Statement
COVID-19	Severe acute respiratory syndrome coronavirus 2
CRY	Child Rights and You
DAK-Gesundheit	Deutschen Angestellten-Krankenkasse
DBE	Department of Basic Education
DVD	Digital Video Disc
ECE	Early childhood education
ICT	Information and Communication Technology
MP3	Moving Picture Experts Group Layer-3 Audio
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
SCT	Social Cognitive Theory
SEL	Social and emotional learning
TV	Television
UK	United Kingdom
UNICEF	United Nations International Children's Emergency Fund
US	United States of America
USA	United States of America
WHO	World Health Organisation

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CHAPTER 1: ORIENTATION OF THE STUDY

1.1 Introduction

Technology and screen time have become part of children's Early Childhood Developmental years. The COVID-19 pandemic increased media exposure even more (Araújo, Veloso, Souza, Azevedo & Tarro, 2020). Screen-time has skyrocketed since the pandemic started, which includes working in virtual classrooms and viewing children's television channels (Cheng & Wilkinson, 2020). Channels such as Disney Channel, Nickelodeon, and Boomerang reported increases in viewing of nearly 60 per cent during a single week (Cheng & Wilkinson, 2020). The school closures in South Africa and strict containment measures have led to more families depending on technology than before, to keep learners learning and entertained during the pandemic (UNICEF, 2020). The COVID-19 pandemic forced schools to resort to transform their normal teaching methodologies, which include the physical and verbal transference of knowledge, into an online format by uploading their teaching techniques and knowledge onto platforms such as Google Classroom, WhatsApp groups, and Zoom interactive classes (Li & Lalani, 2020). Online teaching on a platform such as Google Classroom has its benefits and disadvantages. Online teaching increases the amount of screen time at home as well. The use of electronic devices and increased screen time impacts the behaviour and development of children, both socially and cognitively. On the other hand, learners and teachers had no face-to-face interaction (du Plessis, 2020). Studies have shown that children learn less from a video - they need reciprocal dialogue and have to be able to react to what is being taught to learn more effectively (Cross, 2019). By implication, parents have to decide how and to what extent their children should be using these devices (Marinelli, 2017).

Studies show that electronic devices are beneficial to a certain extent, but these studies also highlight the detrimental effect of these devices (Rocha & Nunes, 2020). Electronic devices are now used as toys and tools for the development of children, but childhood screen time influences can be observed from a very young age. Nearly half of the children aged eight and younger have a tablet or an electronic device, on which they spend about 2.25 hours per day (Cross, 2019). Cross (2019) also stated that screen time can inhibit aspects of childhood development, narrow their interests and limit other means of learning and exploration. This issue with online teaching would

have had a great impact on Grade 2 learners of 2021, who were in Grade 1 in 2020. Grade 1 is the foundation for all future learning, which would mean that these learners would be impacted more than any other grade in the Foundation Phase.

1.2 Background to the study

Electronic device is a term broadly used to describe any device that accomplishes its purpose electronically, which includes TVs, Digital Video Disc (DVD) players, laptops, desktop computers, mobile phones, MP3 players, tablets, and gaming consoles (Reference, 2020). Many devices commonly used today are electronic devices, which use electric current to encode, analyse, and transmit information (CK-12 Foundation, 2019). Bozzola, Spina, Ruggiero, Memo, Agostiniani, Bozzola, Corsello and Villani (2018) differentiate between interactive and broadcast media. Broadcast media is TV and movies, and interactive media encompasses social media, video games and computers. Rocha and Nunes (2020) classified smartphones and tablets as touchscreen devices, while Nugraha, Izah, Hidayah, Zulfiana and Qudriani (2019) in Indonesia refer to electronic devices as gadgets used for watching videos, playing games, communicating and studying. These gadgets refer to mobile phones, desktop computers and televisions. Electronic devices are synonymous with the term screen time and according to Sinnarajah, Balachandran, and Thuraisingham (2019), it refers to time spent watching TV and playing on video gaming devices. Screen time also includes using smartphones, tablets, computers and wearable technology according to Oswald, Rumbold, Kedzior, and Moore (2020).

Children are born social - they have to learn the necessary skills to enable them to communicate and form relationships with others. Social development is a life-long process and determines how social situations are identified, interpreted and reacted to. Healthy social development is beneficial to protecting children’s mental health and wellbeing. Daily contact with family, friends and educators teaches children about the social world. Through these connections, children figure out where they fit in and build identity (BeYou, 2018). Guidance and modelling in daily interactions and incidental opportunities, and planned lessons teach social skills to children (BeYou, 2018). Pathways (2021) pointed out that social skills are crucial for relating to others. These skills help children manage their emotions, build positive relationships, and

demonstrate empathy. Children with functioning social skills are more likely to succeed academically (Pathways, 2021).

Morin (2020) defines cognitive development as the ability to construct meaning and knowledge through experiences. Cognition enables us to consider new information, process it, and act on it. Cognition involves applying new information to previously acquired knowledge, higher level thinking, and skilful information processing (Morin, 2020). Cognitive development improves focusing ability, remembering and critical thinking. These skills benefit children inside and outside the classroom (Morin, 2020). Children actively participate in learning - they experiment, perceive and learn about their world (Cherry, 2020). Children's development is interwoven with technology, which has become more integrated into our lives (Moloney, 2020).

Pinola (2021) states that our lives are becoming increasingly driven by technology. Electronic devices can help children learn in interactive ways, demonstrate creativity, and connect with others. At the same time concern is rising about the impact of screen time on healthy development of children who are bound to technology. An Erikson institute survey reported that 85 per cent of parents provide children under six with technological entertainment at home and 86 per cent stated that they found electronic devices to be beneficial for literacy development, school readiness and success (Pinola, 2021). Morin (2020) confirmed that growing up with a vast array of electronic devices provides endless hours of entertainment and educational content. Morin (2020) pointed out that electronic devices have negative effects on social behaviour, relationships, education, physical health, and sleep. Lee (2019) mentioned that screen time of learners averages 7.5 hours per day, which is linked to lower grades in school.

Research was done on the use of electronic devices and its impact on development has shown mixed results. South African parents overstep screen time guidelines globally and nationally, allowing their children more than one hour of screen time daily. Children from urban high-income homes exceed the guidelines by 67 per cent, while those from low-income urban and rural settings exceed the guidelines by 26 and 3.5 per cent, respectively (Independent Online, 2021). Al Sagr and Al Sagr (2021) in Saudi Arabia suggested that children who mastered the use of electronic devices by primary school age ignore their surroundings, their behaviour is impacted and psychological and cognitive issues arise such as anxiety, depression, attention deficits, learning

problems, and language delays. Rocha and Nunes (2020) noted that screen time may scaffold reading, but for children younger than five the damage is greater than the benefits - mainly sleep disorders, concentration problems and lack of play. The Canadian Paediatric Society (2017) highlighted positive and negative effects. TV programmes that are designed well and have specific educational goals support early language and literacy development. They foster cognitive development through promoting positive racial attitudes and imaginative play. The negative effects include language delays, inattention, poor language use, lower cognitive abilities, short-term memory problems, and early reading difficulties (The Canadian Paediatric Society, 2017). Many other studies have been conducted with similarly mixed results.

Recent studies have found that social and cognitive development is impacted by excessive usage of electronic devices. Beatty and Egan (2018) conducted a study in Ireland with parents of 9,000 five-year-olds and found that children who spend an exorbitant amount of time on educational games and watching TV scored significantly lower in their ability to reason. Children devoted to computer and video games had significantly lower scores in vocabulary development (Beatty & Egan 2018). Beatty and Egan (2020) found in a more recent study that children who were participated in various activities for three hours daily scored higher on reasoning ability than those who were only using electronic devices. Beatty and Egan also suggested that TV viewing can improve vocabulary development if the content is appropriate for the developmental level of the children and exposure is not prolonged. Kardefelt-Winther (2017) stated that digital technology can enhance social relationships and moderate use is beneficial for mental wellbeing, however excessive usage may have negative effects. Dore, Zosh, Hirsh-Pasek and Golinkoff (2017) found that screen time has a positive impact on language development by being interactive and responsive, such as in interactive reading applications. Researchers have recently been interested in the impact of electronic devices, since technology is integrated with our daily lives and those of children from a young age. More than 75 per cent of families own mobile devices and screen time and usage is rising (Lissak, 2018). In the United Kingdom (UK), 82 per cent of five to seven-year olds are online, 42 per cent own their own tablet and 97 per cent watch TV for an average of 13.5 hours per week (Burns & Gottschalk, 2019). The usage of electronic devices can be beneficial by supporting social interactions and developing cognitive reasoning and early reading and language skills;

however, the detrimental effects cannot be ignored. The excessive use of these devices impacts all areas of childhood development, specifically social and cognitive development. Rocha and Nunes (2020) confirmed that screen time decreases time spent on important childhood activities, such as creative play and reading, and increased screen time corresponds with sleep disorders, concentration problems, and obesity.

Studies have shown mixed results on how parents and teachers experience excessive electronic device usage. A study done in Canada found that parents believe that TV viewing has educational benefits and supports wellbeing (Archer, 2017). A study done in the USA highlighted that parent and child attachment interactions are critical to brain development, which impacts emotional processing and self-regulation. Electronic devices can interfere with these interactions - even background TV negatively impacts the quantity and quality of social interactions (Courtney & Nowakowski-Sims, 2018). Another US study found that 70 per cent of parents are concerned about their children spending too much time in front of screens and they were distressed about the possible impact of screen time on development.

Parents are concerned about their children's interpersonal skills, healthy friendships, and school performance (Auxier, Anderson, Perrin & Turner, 2020). Not many studies have been done on teachers' experiences with excessive electronic device usage. One of the US studies suggested that the technological trend has impacted daily learning (Thomas, 2018). Over 90 per cent of Early Childhood Educators use computers in class to foster social interaction and as a teaching tool (Thomas, 2018). A study done in Australia by the Murdoch Children's Research Institute with eight and nine-year-olds revealed that too much screen time had a negative impact on learning abilities and produced lower reading performance (Blundell, 2020).

Time spent on electronic devices since 2020 increased dramatically, due to the COVID-19 pandemic. Millions of learners were compelled to switch to online learning and time spent on social media skyrocketed according to studies done in the UK, US and Spain. Visits to websites and apps increased 100 per cent in January 2021, compared to the previous year, specifically on sites like TikTok and YouTube (Geddes & Marsh, 2021). During the lockdown in the US, learners spent two to three hours in front of a screen for Zoom lessons and Google Classroom. The National Institute of

Health study found that exceeding two hours of screen time per day led to learners scoring lower on language and thinking tests, as well as being less able to focus. Learners were also experiencing emotional meltdowns – as they lacked the social development to control emotions (D'Souza, 2020).

The COVID-19 pandemic completely redefined the way our lives are lived and resulted in excessive electronic device usage by learners during 2020 and during the first school term of 2021. Most schools continued with split classes and online classes were still offered to learners at home. The rise in screen time during the COVID-19 pandemic will impact learners in the Foundation Phase greatly. At this time, the consequences are still murky and it may take years to understand the effects (Kelly, 2021).

Previous studies have shown that excessive screen time causes language delays, attention problems, delayed language development, lower cognitive abilities, and decreased communication and interaction (Canadian Paediatric Society, 2017; Beatty & Egan 2018). Studies have been done worldwide regarding the increase in screen time during the COVID-19 pandemic. A Canadian study reported an increase of screen time in learners of 87 per cent, while in China 70 per cent of the 1,033 participants spent more time on electronic devices (Sultana, Tasnim, Bhattacharya, Hossain & Purohit, 2020). Studies conducted in the US by the National Institute of Health (D'Souza, 2020) highlighted the detrimental effects of increased screen time, and a study done by Dorn, Hancock, Sarakatsannis and Viruleg (2020) from consulting firm McKinsey & Company estimated that the shift to online learning set learners back by up to three months of learning. Statistics South Africa (2020) reported that 25 per cent of learners were not involved in home-schooling. The report also stated that children spent more time viewing television and browsing the internet during the lockdown. Despite the fact that this phenomenon has received huge attention among researchers across the globe it would appear that empirical evidence is lacking on the impact of electronic devices in the time of the COVID-19 pandemic on the social and cognitive development of learners within South Africa. A study regarding the impact of electronic devices in the time of the COVID-19 pandemic on the social and cognitive development of learners within South Africa, will provide insight into the consequences of excessive screen time usage. The study will provide information on the aftermath

of the COVID-19 lockdown regarding social and cognitive developmental delays of learners and on how to address these issues to support the development and learning of learners. Against these backgrounds, it is, therefore, necessary to embark on the study of the impacts of electronic devices on the social and cognitive development of learners in the time of the COVID-19 pandemic.

1.3 Problem statement

Previous studies worldwide have shown that excessive screen time has detrimental effects than benefits on children's development. Social development affects how social situations are recognised, interpreted and responded to, while cognitive development affects one's ability to gain meaning and knowledge from experience and information. Both of these developmental domains impact a child's success inside and outside the classroom. Excessive electronic device usage is linked to lower cognitive abilities, learning problems and social interaction and language development issues. COVID-19 has also increased media exposure, due to online teaching and increased time spent on electronic devices. South African researchers have yet to conduct studies on the impact of electronic devices in the time of the COVID-19 pandemic on the socio-cognitive development of learners. Thus, this study intends to determine the impacts of electronic devices in the time of the COVID-19 pandemic on the socio-cognitive development of Grade 2 learners of 2021 in South Africa. These learners were in Grade 1 during 2020 and the National Lockdown, which is a crucial time for Foundation Phase learners, where all the fundamental skills are being developed for future learning. This study will determine the amount of time learners normally spend on electronic devices and how much time was spent on electronic devices during the COVID-19 pandemic, after which the impact of electronic device usage on the socio-cognitive development of Grade 2 learners of 2021 will be examined.

1.4 Rationale for the study

Studies worldwide have been done on screen time and its effect on development. Many studies on this topic were done internationally. This study focuses on the South African context, bearing in mind that our cultural and ethnic diversity differs greatly from that of America or other countries in which such studies have been conducted. South African researchers have not studied the impact of electronic devices during the COVID-19 pandemic on the socio-cognitive development of learners. COVID-19

impacted schools and teaching greatly – teaching methods had to be adapted to offer online classes to children. Teachers in Cradock reported a variety of issues when learners returned to school: they fell behind with their work. Some learners did not complete any online work and had little motivation to return to school. This study is necessary because it promises to provide empirical evidence on how the perceived increased use of electronic devices among learners during the COVID-19 pandemic may be affecting the wellbeing of learners. This study aims to determine the impacts of electronic devices during the COVID-19 pandemic on Grade 2 (2021) learners' socio-cognitive development - who are now in Grade 3.

1.5 Aim of the study

This study aims to explore the impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development.

1.5.1 Specific objectives

1.5.1.1 To determine the amount of time that Grade 2 learners normally spend on electronic devices.

1.5.1.2 To determine the amount of time that Grade 2 learners spent on these devices during the COVID-19 pandemic.

1.5.1.3 To categorise learners into different levels of electronic device usage (minimal usage = 1 to 2 hours per day, average usage = 3 to 5 hours per day, high usage = 6+ hours per day).

1.5.1.4 To assess the impact of different levels of electronic device usage on the social development of learners.

1.5.1.5 To assess the impact of different electronic device usage levels on learners' cognitive development.

1.6 The Main research question

What is the impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development?

1.6.1 Sub-research questions

1.6.1.1 What is the amount of time that Grade 2 learners normally spend on electronic devices?

1.6.1.2 What is the amount of time that Grade 2 learners spent on electronic devices during the COVID-19 pandemic?

1.6.1.3 What are the levels of usage of electronic devices by learners during the COVID-19 pandemic?

1.6.1.4 What is the impact of different levels of electronic devices used on the social development of learners?

1.6.1.5 What is the impact of different levels of electronic devices used on the cognitive development of learners?

1.6.2 Hypotheses

Electronic device usage during the COVID-19 pandemic and how it significantly impacts the socio-cognitive development of Grade 2 learners.

1.6.2.1 There is no significant difference in the amount of time learners spent normally on electronic devices and the amount of time spent on them during the COVID-19 pandemic.

1.6.2.2 There is no significant difference in the levels of usage of electronic devices by learners during the COVID-19 pandemic.

1.6.2.3 There is no significant impact of different levels of electronic devices used on the social development of learners.

1.6.2.4 There is no significant impact of different levels of electronic devices used on the cognitive development of learners.

1.7 Scope of the study

This study focuses on the impacts of electronic devices usage on South African learners in Grade 2 in 2021, who were in Grade 1 during the COVID-19 National Lockdown of 2020. These learners have since progressed to Grade 3 and the study was adapted accordingly. The study was done in a rural town in the Eastern Cape in South Africa. It is a preparatory school, which only includes Grades 1 to 3. It is a double medium school (Afrikaans and English). Learners come from culturally and ethnically diverse households. Parents were invited to complete a questionnaire regarding the normal electronic device usage of their children and the amount of time spent on electronic devices during the COVID-19 pandemic. Learners are then categorised as minimal usage, average usage, or high usage of electronic devices, after which they

completed a mathematics achievement test (cognitive development) and their teachers completed a Social Development Questionnaire regarding the learners individually.

1.8 Significance of the study

The use of electronic devices impacts the social and cognitive development of learners. During the National Lockdown of 2020 and the ongoing pandemic, the amount of time spent using these devices increased. Previous studies have focused on the benefits and negative effects of using electronic devices. This study determined the impacts of electronic device usage during the COVID-19 pandemic. The findings of this study will benefit learners, parents, and early childhood educators. The findings will inform parents and early childhood educators about the social and cognitive developmental delays caused by electronic device usage. The findings will also enable parents and early childhood educators to address these delays, promote healthy childhood development and limit daily electronic device usage. The findings will also inform the Department of Basic Education (DBE) on the developmental impact of electronic device usage during the COVID-19 pandemic and enable them to address the developmental delays for effective intervention and teaching.

1.9 Definition of operational concepts

Electronic devices: Electronic devices refer to televisions, computers, electronic games on gaming consoles (Xbox or PlayStation), and hand-held devices such as cell phones and tablets. Screen time is also used to refer to time spent on electronic devices.

COVID-19 pandemic: An ongoing global pandemic of the coronavirus disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was first identified in China in December 2019.

National Lockdown: The time during which the COVID-19 pandemic was at its worst in South Africa in 2020, which led to the National Lockdown from 26 March to 20 July 2020.

Social development: The process by which children learn to interact with family, peers, teachers, and others around them and the skills required to communicate with others and process their actions.

Cognitive development: The development of knowledge, skills, problem-solving, and reasoning which enables children to think about and understand the world around them.

1.10 Preliminary literature review

1.10.1 Introduction

The impacts of electronic devices on the social and cognitive development of learners during the COVID-19 pandemic is a relatively new topic in academic discourse. The impacts of electronic devices on childhood development have been a topic of interest for many researchers worldwide, but literature on the impacts of increased electronic device usage during the COVID-19 pandemic is scarce. The lack of empirical knowledge poses a challenge in expanding the body of knowledge regarding the impacts of increased usage of electronic devices on the social and cognitive development of learners who were in Grade 1 during the National Lockdown in South Africa. The first section of this preliminary literature review explores the conceptual framework of the study. The next section discusses the COVID-19 pandemic, followed by the various types of electronic devices. The social development of learners is presented next, followed by the cognitive development of learners. Synopsis of Bandura's Social Cognitive Theory is discussed as a theoretical framework for the study.

1.10.2 Conceptual framework

1.10.2.1 The Coronavirus (COVID-19) pandemic

The current COVID-19 pandemic arose from the coronavirus SARS-CoV-2. This virus causes respiratory diseases in humans, which range from the common cold to more rare and serious cases with high mortality rates (WHO, 2020). The World Health Organisation (WHO) announced a number of pneumonia cases in Wuhan City, China on 31 December 2019. SARS-CoV-2 was confirmed as the causative agent, which is an infectious disease spread directly and indirectly from one person to another through

close contact, droplets, and contaminated objects (Government of South Africa, 2020). The virus spread worldwide at an alarming pace and featured a high mortality and morbidity rate. WHO declared COVID-19 a global pandemic on 11 March 2020 (Nyashanu, Simbanegavi & Gibson, 2020). South Africa acted swiftly and severely after the WHO's declaration to curb the spread of the virus and declared a National Lockdown effective as of 26 March 2020 (Government of South Africa, 2020; Spaull & van der Berg, 2020). The lockdown started as a three-week period, which morphed into eight weeks of strict quarantine. Schools and crèches were closed during this period, temporarily reopened for Grades 7 and 12 and subsequently closed again (Spaull & van der Berg, 2020). The lockdown officially ended in August 2020 and Foundation Phase learning (Grades 1 to 3) opened on 24 August 2020 after being closed for five months (Government of South Africa, 2020).

1.10.2.2 Electronic devices and types

Electronic devices are used daily, such as a smartphone which is checked constantly, with a camera; accompanying us on travels and television which enables us to binge-watch our favourite shows (Eadicicco, Peckham, Fitzpatrick, Pullen, Luckerson & Howorth, 2016). These devices form an important part of our day-to-day life and simplify our daily work. The National Council of Education and Training (2020) classifies these devices as consumer electronics, which are made for everyday use.

Consumer electronics are further categorised as office gadgets like personal computers, projectors and printers; home appliances like refrigerators and washing machines; audio and video systems such as DVD players, TVs, and video game consoles; advanced consumer devices like smartphones and tablets; and storage devices such as MP3 players.

Smartphones are defined as cellphones and cater for more than sending text messages and making phone calls (Computer Hope, 2021). Smartphones can be used to browse the internet and run software applications like a computer. Touchscreen technology is used to interact with software and thousands of applications are available for use, including games, and personal and business applications. Smartphones enable users to take, show and store pictures and video, as well as record and play audio and music (Computer Hope, 2021).

Computers are electronic devices that manipulate data and information (Goodwill Community Foundation Global, 2019). They can store, retrieve and process information. They enable users to type documents, send emails, browse the web and play games. Users can create or edit presentations, videos, and spreadsheets on computers. A personal computer can refer to a desktop computer that is placed on a desk and is stationary, or a laptop that is battery powered, more portable and can be used almost anywhere (Goodwill Community Foundation Global, 2019).

Tablets are highly portable personal computers of which the primary interface is a touchscreen (Lenovo, 2019). The touchscreen fills the length and width of the device and the speaker and microphone are optimised for hands-free calling. Tablets blend the best features of smartphones and laptop PCs, thereby creating a grand mobile computing experience. Tablets enable users to browse the web, play interactive games, and use an array of applications for work and entertainment (Lenovo, 2019).

Televisions (TVs) are defined as box-shaped devices that receive electrical signals and convert them into moving images and sound (Cambridge Dictionary, 2021). Smart TVs are a succession of a computer and a regular TV, which integrates internet and web features. They enable users to view content on apps, browse the internet, and stream music and videos (Donovan, 2021). Streaming services like Netflix and Hulu are very popular among users and they can also watch classic programmes, movies, and children's shows on a Smart TV. Smart TV also enables users to play games with or without a gaming console (Bates, 2018).

Video gaming consoles are gaming boxes or devices that are primarily designed to play games on a TV. Examples of gaming consoles include Microsoft Xbox, Sony PlayStation, and Wii (Computer Hope, 2020). Gaming consoles allow for shared gaming experiences through co-op gaming, as well as online gaming. Gaming consoles can also be used as a media centre for regular TVs, by enabling users to access streaming services such as Netflix, Hulu, YouTube, and Spotify. These consoles can play Blu-Ray discs and USB files (Brookes, 2020).

1.10.2.3 The social development of the learner

Early childhood social development is crucial to overall health and wellbeing throughout life. It is linked closely to cognitive and emotional development, forming the

foundation for developing relationships and enduring stressful situations (Reflection Sciences, 2017). Social development is the emerging ability to form secure peer and adult relationships, articulate and manage emotions in socially and culturally appropriate ways, and learn from exploring the environment. This all happens in the context of culture, family, and the community. Social development facilitates perspective taking, emotional control, and self-confidence (Darling-Churchill & Lippman, 2016). Social competency is increasingly recognised as a key factor for children's success in school and other settings later in life. Social experiences with primary caregivers and interacting with other children and adults at a young age influence prospective academic and personal outcomes and fortify other areas of childhood development (Darling-Churchill & Lippman, 2016). Social and emotional skills are crucial for school readiness and executive function skills play an essential role in development, enabling learners to focus in class, shift between activities, and cooperate with others. The executive function directs all cognitive skills, which helps people control behaviour, develop relationships and accomplish tasks (Reflection Sciences, 2017).

By the age of five, children are aware of their individualism and can develop friendships with peers. They can understand thoughts and feelings and initiate or join in play with peers and create their own games (Reflection Sciences, 2017). Malik and Marwaha (2020) confirmed that by the ages of five and six, children spend more time in peer groups and identify with friends. Their imaginary play is more elaborate and they act out fantasies. By the ages of seven to eight, children develop a deeper understanding of relationships and responsibilities, while moral development progresses and coping skills become more complex. Darling-Churchill and Lippman (2016) declared that maladjustment in the social development domain can impede the ability to function in a school, family, or other contexts. If children fail to establish secure attachments, they will experience difficulties later on with conveying or controlling emotions and may be unable to develop healthy relationships with peers (Darling-Churchill & Lippman, 2016).

1.10.2.4 Cognitive development of the learner

Cognitive development is all about learning and is influenced by genes and experiences. Cognitive development is the workings of the mind, how children think,

perceive their world and implement what they learn (Virtual Lab School, 2019). During the initial years of a child's life, substantial brain development takes place that is crucial to cognitive development. Between the ages three to five, accelerated growth occurs in various cognitive domains, including language processing and higher-order cognition processes, which are executive functions. Executive functions enable us to hold things in our minds and suppresses prepotent behavioural tendencies. Executive functions and cognitive ability in early childhood predicts various fundamental life outcomes, such as mental health, academic achievement, and work success (Verswijveren, Wiebe, Rahman, Kuzik & Carson 2020).

Increasingly competent executive functions of childhood empower children to operate in ways that make them successful students and friends to peers (Centre on the Developing Child at Harvard University, 2020). These first few years are also critical to overall development, since the brain's ability to adapt reduces with age (Wright, 2017). Cognitive skills include logic and reasoning, memory and working memory, attention, flexibility and adaptability, and exploration of cause and effect (Wright, 2017). During the preschool years, amazing changes occur in thinking skills. Children use their imagination to play and learn. They can compare, contrast, organise and analyse information and develop more complex ways to solve problems. Their mathematical and scientific thinking also becomes more sophisticated. It is important to note that thinking skills develop in a predictable sequence, but every child's development is unique (Virtual Lab School, 2019). Opportunities to maximise cognitive development in early childhood should be identified to ensure optimal health and wellbeing later in life (Verswijveren, *et al.,* 2020).

1.10.3 The synopsis of Theoretical framework – The Social Cognitive Theory of Albert Bandura

The Social Cognitive Theory (SCT) is a psychological perspective on human behaviour, which emphasises the crucial role of the social environment on motivation, learning, and self-regulation (Schunk & DiBenedetto, 2020). This theory emphasises the importance of observational learning, which occurs when individuals observe a model, remember what the model did, are able to repeat the observed behaviour and have the motivation to do so. The motivation for the performance of modelled actions depends greatly on positive consequences. These expected outcomes are cognitive

ideologies, which are refined through social interactions between observers and models (Schunk & DiBenedetto, 2020).

Fundamentally, this theory accentuates the mutual relationship and interaction between characteristics of the individual, conduct and the environment. Individuals have an agentic, active role in facilitating learning and creativity (Rubenstein, Ridgley, Callan, Karami & Ehlinger, 2018). Individuals seek this sense of agency, which is the ideology that they have a considerable degree of influence on momentous events in their lives. Individuals use self-regulative and cognitive capabilities to set goals and implement strategies to achieve them (Schunk & DiBenedetto, 2020). Ayre and Krishnamoorthy (2020) pointed out that behaviour is about socialisation and the reciprocal influence of other people's behaviour on ours. The key element is shared experiences with others and the moulding of children's conduct through modelling of the desired behaviour and the reproduction thereof. Therefore, the key elements of the SCT are modelling, observing and copying the behaviour. The key components for successful modelling are attention, retention, motor reproduction and motivation (Ayre & Krishnamoorthy, 2020). Albert Bandura's Social Cognitive Theory is a fitting framework for the intended study, as it emphasises both the social and cognitive development of children and highlights the close link between social and cognitive development. The SCT proposes an intentional active role of individuals in generating outcomes and highlights the importance of the educational environment and modelling process (Rubenstein *et al*., 2018). This theory is grounded in social observational learning and cognitive processing, which then leads to produced behaviour supported by cognitive beliefs and positive consequences (Schunk & DiBenedetto, 2020). The SCT can be applied to determine how electronic media and content affect children's social behaviour, on the basis that children learn in the context of social relationships (Kara, 2018). This theory is therefore applicable because children copy the modelled behaviour of parents and peers regarding the usage of electronic devices. This study will explore observational learning regarding electronic device usage and the impacts thereof on the social and cognitive development of learners, due to a lack of social interaction with peers and other adults during the ongoing COVID-19 pandemic.

Recent studies have applied the SCT with success. Rubenstein *et al.* (2018) conducted a mixed-method study on teachers' perceptions of creativity by applying

the SCT factors of personal characteristics, behaviour and environment, to determine how they facilitate learning and creativity. The focus was on the role of the teacher and their perceptions and characteristics and how teachers' sense of agency led them to act intentionally and influence learner creativity (Rubenstein, *et al.,* 2018). Rubenstein *et al.* (2018) achieved success with the application of SCT and discovered that the teachers and their beliefs are uniquely situated in an interactive, reciprocal and agentic context depictive of classroom roles. A case study was done by Kara (2018) on the Screen-Free Week Project. Voluntary families participated in reducing screen time for a week. The study highlighted the importance of family-child interaction, watching programmes and playing games with children. Families set a suitable time limit for screen time that was appropriate for the developmental level of children. The project was successful and aims to become more widespread in the future. Alsadah (2017) conducted a qualitative study on the use of electronic media and its impact on the social development of children and parental views on media usage. SCT was applied based on its principles of communication, imitation, observation and modelling. Alsadah (2017) proved that children are unable to properly develop social skills when not becoming involved in real life situations. Parents who confirmed heavy device usage by children claimed that device usage is an essential skill, but some of their children struggle to communicate and express their feelings.

1.11 Research methodology

1.11.1 Introduction

This section covers the research methodology that will be implemented in the study. Firstly, the research paradigm will be explained, followed by the research approach. Then the study design will be described, followed by the study site. Population, sample size, sampling procedures, and selection of participants will be described as well. Thereafter, the instruments for data collection, measurement of the validity, reliability, and piloting of the instrument, and the data collection and analysis procedures will be discussed.

1.11.2 Research paradigm

The research paradigm pertaining to this study is the scientific research paradigm. This paradigm is a broad structure that encompasses viewpoints, beliefs, and an

awareness of various theories and practices employed during scientific research (Zukauskas, Vveinhardt & Andriukaitiené, 2018). This paradigm is a precise procedure with several stages. The researcher establishes a relationship between the research aims and questions. This paradigm depends on various factors, including the individual's mentality, view of the world, and various perceptions, beliefs, and attitudes that are connected to the perception of reality. The researcher's beliefs and values are key to this concept, in order to provide sound arguments and terminology for obtaining reliable results. The scientific research paradigm can therefore be described as the approach used in the research, the accomplishing process, and the method of implementation (Zukauskas *et al.*, 2018).

1.11.3 Research approach

The study used a quantitative research approach. A researcher identifies a research problem based on trends in the field or explains why something occurs. The research problem can be answered effectively by a study in which the researcher wants to determine the overall tendency of responses from individuals and then notes how varied this tendency is among people (Leavy, 2017). Quantitative research centres around breadth, statistical descriptions, and generalisability, objectivity, control and precise measurement. Quantitative approaches rely methodologically on deductive designs which build evidence in favour of specific theories and hypotheses (Leavy 2017). Quantitative data, such as the time learners spend on electronic devices, yields numbers that can be statistically analysed and used to describe trends about a large number of people (Leavy, 2017).

1.11.4 Design of the study

An ex-post facto design will be implemented in this study. This design is used to explore possible causal relationships among variables that the researcher cannot control. The researcher designs the study to compare two or more samples that can be compared, except for a specified factor that occurred in the past (Akinlua, 2020). The possible causes are studied after they have occurred. Rather than controlling what will happen to subjects, the research focuses on what has occurred differently for comparable subject groups, and then explores whether the subjects in each group differ in some way (Akinlua, 2020).

1.11.5 Study site

The study site for the research was a preparatory school in Cradock, a rural town in the Chris Hani District of the Eastern Cape in South Africa. Cradock consists of the suburbs of Cradock, Lingelihle and Michausdal (Cradock-info, 2021; Municipalities, 2016). The population of the town was 70,493 in 2016 and is culturally and ethnically diverse, including different races; namely Caucasian, Black, Coloured, and Indian (Municipalities, 2016). The school reflects the population of the town. The learners reside in town and in the surrounding suburbs. The school advocates the usage of electronic devices for teaching, including laptops, projectors, visualisers, and interactive whiteboards in all of the classrooms.

1.11.6 Population, sample size, and sampling procedures

The key population for the study, the Grade 2 learners, have progressed to Grade 3 since 2021 and the study was adapted to the developmental level of Grade 3 learners. The study population incorporated the parents of the Grade 3 learners, the Grade 3 learners and their teachers at the school. Their children were in Grade 1 during the National Lockdown of 2020 and their learning was seriously impacted by online teaching and a lack of face-to-face classroom time. The learners' parents participated in the study, to give insight into the electronic device usage of these learners at home.

The Grade 3 teachers were able to answer the Social Development Questionnaire about the learners since they had been working closely with the learners and had observed their social interactions. The teachers were able to answer the questions honestly, without worrying about the social desirability of answers, whereas parents may have answered the questions about their children's social development in a manner that they deemed socially desirable. There are 108 Grade 3 learners at the school who were invited to complete the first data collection instrument, after which a sample of ten Grade 3 learners per category, their teachers, and their parents were invited to participate in the rest of the study. A purposive sampling technique was used to select the participants who were representative of the study's target population. This sampling method seeks out information rich cases for the study, which will be able to address the research questions (Leavy, 2017). In this case, the population of the four Grade 3 classes is representative of the population of the town, which makes the

results more generalisable. The parents and teachers of these children are also considered information rich.

1.11.7 Instruments for data collection

First, all data was collected using Google Form Questionnaires. Survey research is popular in education for its adaptability, efficiency, and generalizability (Leavy, 2017). The first questionnaire focused on the amount of time learners spend on electronic devices before and during the COVID-19 pandemic. The questionnaire link was sent to all Grade 3 parents on the class WhatsApp group, inviting parents to participate in the study. Parents had a week to complete the questionnaire. Second, a Social Development Questionnaire was sent to the teachers to complete after learners had been categorised into levels of usage (i.e., ten learners per group). The levels of usage are minimal usage (one to two hours per day), average usage (three to five hours per day) and high usage (6+ hours per day). They had two weeks to complete the questionnaire. Last, an achievement test was conducted at about the same time. The achievement test was printed out for the learners to complete, after which the researcher recorded their answers on the Google Form. Achievement tests have a more restricted coverage than aptitude tests, they measure more recent learning and are closely tied to school subjects (Frey, 2018). The recipients completed the test in groups of ten, scheduled after school in a classroom.

1.11.8 Measures of instruments' validity and reliability and piloting

Face validity determines if the instruments are measuring what they are supposed to measure (Leavy, 2017). Thus, the instruments were face validated by two experts in Early Childhood Education (ECE) and Care. The experts were requested to look at the instruments in terms of the appropriateness of the items to the research aims, the language of the instruments as well as the ability level of the mathematics achievement test. The comments of the experts were used to modify the instruments accordingly.

After the validation, the modified instruments were subjected to pilot testing on three learners, their parents, and their teachers. The data to be obtained using the survey questionnaires was subjected to Cronbach Alpha reliability estimates to get the internal consistency reliability indices of the questionnaires. Their reliability indices

were estimated accordingly. On the other hand, the data to be obtained using the mathematics achievement test was subjected to the Kuder-Richardson formula twenty reliability estimate to determine the reliability of the test.

1.11.9 Data collection procedure

First, a letter was sent to the principal of Cradock Preparatory School to inform the school of the intended study and to ask permission to use the school as a conduit between the parents and the researcher. Second, the Grade 3 teachers were asked to send the link to the Google Forms Questionnaire to the parents of these learners. Both the letter to the principal and the questionnaire bore the contact details of the researcher and relevant information regarding the study. The data was then collected via a Google Form Questionnaire that was completed by the Grade 3 parents. The purpose of the questionnaire was to determine the number of time learners spent on electronic devices before the COVID-19 pandemic and the amount of time spent during the pandemic. The questionnaire link was sent to all Grade 3 parents on the class WhatsApp group, inviting parents to participate in the study. Parents were given a week to complete the questionnaire. The Social Development Questionnaire was sent to the teachers to complete when the learners had been categorised into levels of usage, ten learners per group. They were given two weeks to complete the questionnaire. The achievement test was conducted at about the same time. The achievement test will be printed out for learners and they can complete it, after which the researcher will record their answers on the Google Form. They completed the test in groups of ten, scheduled after school and in a classroom at school. The date and time were scheduled with parents and teachers beforehand.

1.11.10 Data analysis procedure

The quantitative data was collected using online Google Form Questionnaires, of which the responses were converted to Google Sheets. Descriptive statistics were used to detail and summarise data in order to answer the research questions, while inferential statistics were used to test the hypotheses (Leavy, 2017). The data was specifically analysed using frequency, percentage and mean to answer the research questions while the hypotheses was tested at a 0.05 level of significance using analysis of variance. Once the analysis had been concluded, the results of the descriptive and inferential analysis were represented visually (Leavy, 2017).

1.12 Ethical considerations

1.12.1 Gaining entry

Gatekeepers for the research project were contacted and asked for permission and consent to perform the study (Leavy, 2017). The gatekeepers for this project are the school governing body, principal, teachers, and parents. The gatekeepers were informed of the aims of the study and all relevant information. The study was conducted with respect to all gatekeepers. Learners completed the achievement test after school, which did not interfere with learning time.

1.12.2 Participants' right

Participants have a right to ask questions and participation is voluntary (Leavy, 2017). Parents gave their consent for their children to participate in the study. If a learner was unwilling to complete the achievement test for the study, he or she could refuse to participate. Consent was checked on continuously - a learner, teacher or parent was allowed to change his or her mind. An opt-out letter was sent to parents, which they only completed and sent back if they did not want their child to participate. This also gave learners an opportunity to decide if he or she wanted to participate.

1.12.3 Informed consent

Consent was informed. The study aims and methods were explained to the principal, the school governing body, teachers, parents, and learners. Parents and teachers completed a consent form with all of the relevant information regarding the study and their roles in it. Parents also filled in a consent form regarding their children's participation. The consent form also informed participants about the potential discomforts and benefits of participating. The research was also explained to the learners in a manner that they understood, through a PowerPoint Presentation. The researcher explained the benefits of the intended research to the target population and made it clear that they were in no manner being exploited (Leavy, 2017).

1.12.4 Obtaining consent

Parents were informed about all aspects of the study and asked to give consent for their children to participate in the study. Leavy (2017) pointed out that if parents or legal guardians give their consent, learners may be asked to assent to a study. This

means that they agree to participate after knowing about the study and any potential for risk or harm. Assent is obtained when minors are old enough to understand that they are volunteering to participate and may choose to refuse participation without penalty (Leavy, 2017). Parents and learners were required to complete the informed assent form if they chose to participate in the study.

1.12.5 Confidentiality

All responses given via the questionnaires were confidential. No visual data was collected. The data collected and an undertaking was made that the participants of the study would not be discussed with anyone not involved in the study. Numbers were assigned to learners to ensure that they could not be linked to participants after the study had been completed (Leavy, 2017).

1.12.6 Protection from harm

Participants can cause distress if not managed properly. In the study, If a parent did not want a child to participate, he/she would not be forced to do so. No physical or mental harm was done to participants. The questionnaires were distributed and administered without embarrassing, offending, frightening, or harming participants. This was made possible by teachers and parents completing questionnaires from the privacy of their homes. Learners were required to complete the achievement test in a classroom setting, which was familiar to them and provided a safe environment (Leavy, 2017).

1.12.7 Achieving anonymity

Results and participants remained anonymous - each participant was given a number. All data corresponding to the participant was linked to their given number. If any participant wished for their name to be used, a pseudonym was be given with the help of the child or parent (Leavy, 2017).

1.12.8 Maintaining professionalism

Data, results, methods, and procedures were reported honestly. No data was fabricated, misrepresented, or falsified. Gatekeepers (parents, principal, school governing body, teachers, and learners) were not deceived with regard to the aims and procedures of the intended study (Leavy, 2017).

1.12.9 Participants' vulnerability

The participants in the study were parents, teachers and learners. The participants were treated with the utmost respect and were not placed in a situation where they felt vulnerable. They could decide if they wanted to participate and to what extent they wished to respond to questions on the questionnaire (Leavy, 2017).

1.13 Organisation of chapters

Chapter 1: Orientation of the Study
Chapter 2: Literature Review
Chapter 3: Research Design and Methodology
Chapter 4: Research Results
Chapter 5: Conclusions and Implications

1.14 Chapter summary

In this chapter, an introduction and background to the study regarding the impacts of electronic devices on the social and cognitive development of learners during the COVID-19 pandemic was done. It was followed by the problem statement and rationale for the study. The aims, objectives and research questions were stipulated in the sections that followed. The hypotheses for the study were followed by the scope and significance of the study. Operational concepts, such as electronic devices and the COVID-19 pandemic, were defined. A preliminary literature review, conceptual and theoretical framework and a review of related empirical studies followed. The research design and methodology were discussed, followed by the ethical considerations in the following section. The chapter concluded with the organisation of chapters, a chapter summary and references used for Chapter 1. Chapter 2 will focus on a literature review of recent and relevant studies on the topic of the impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The onset of the COVID-19 pandemic resulted in national lockdowns and quarantine, leading to social isolation from friends and family (Chetty, Munsamy, Cobbing, van Staden & Naidoo, 2020:1). Social isolation and distancing became the norm during the ongoing pandemic. Worldwide, people are turning to electronic devices for social interaction, online learning and work. Predictions have been made that COVID-19 will transform how interactions will take place after the pandemic is completely over (Chetty et al., 2020:1). The previous chapter introduced the background to the study, whereas Chapter 2 focuses on the conceptual framework, theoretical framework and a review of related empirical studies. The conceptual framework comprises the COVID-19 pandemic, electronic devices and types, followed by the social and cognitive development of learners. The theoretical framework section describes Bandura's Social Cognitive Theory and how it was implemented in this study. The final section includes reviews of related empirical studies regarding the usage of electronic devices by learners during the COVID-19 pandemic and the impact of the usage of different electronic devices on learners' social and cognitive development. The literature review chapter concludes with a summary.

2.2 Conceptual framework

The conceptual framework of a study comprises the logical associations and orientation of everything that formed the basic structures, thought processes, practices and execution of the project (Kivunja, 2018). Crawford (2020) emphasised that the conceptual framework describes the main concepts to be studied, such as key factors, variables and the anticipated relationships between them. The conceptual framework examines a specific set of individuals or setting, which forms part of a larger phenomenon. A researcher links research questions to greater theoretical constructs, which shows that the research may hold significance for the relevant field (Crawford, 2020).

Kivunja (2018) stated that a conceptual framework encompasses the researcher's ideas on identifying the research topic, the research problem to investigate, relevant research questions, review of literature, application of theories, methodology, data

analysis and interpretation of research findings, conclusions and recommendations to be made. The conceptual framework is therefore the master plan for a research project (Kivunja, 2018). The conceptual framework for this study defines the following concepts: The Coronavirus (COVID-19) pandemic; electronic devices and types; the social development of the learner; and the cognitive development of the learner.

2.2.1 The Coronavirus (COVID-19) pandemic

The sweeping severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) has reached upwards of 200 territories and countries across the globe (Schröder, Bossert, Kersting, Aeffner, Coetzee, Timme & Schlüter, 2021). The continent of China was hit first by the outbreak in January of 2020. China enforced drastic interventions, which included an almost full lockdown for eleven weeks. However, by April 2020, China reported 83,500 cases of the virus. Since April 2020 various European countries have reported upwards of 100,000 cases each, while the USA reported more than one million cases (Schröder *et al*., 2021). During this period, South Africa reported approximately 5300 cases, which escalated to 2,95 million cases and 89,791 deaths by November 2021, according to the COVID-19 South African Online Portal (2021). The South African National Lockdown Level 5 was announced on 27 March 2020, which included a full closure of childcare centres, primary and higher education and halting of public leisure activities. In addition, the physical distancing of 1,5 metres and a 70 per cent of shopping reduction was enforced. Only 85 per cent of the South African workforce were allowed on-site (Schröder *et al*., 2021). Schools were closed from 27 March to June 2020, and then again in August. Schools were partially opened for Grades 7 and 12, to attempt to regain some of the school days lost - which amounted to 30 to 59 schooldays lost (Timm, 2021). The first wave peaked at 13,900 cases in July 2020, succeeded by the second wave, during which daily cases peaked at 21,606 by January 2021 (COVID-19 South African Online Portal, 2021). The third wave saw cases rising more rapidly than previous waves, peaking at 16,585 daily cases by July 2021. The third wave was likely driven by a mix of social mixing, public fatigue regarding strict measures, and unsuccessful use of social measures and public health, new variants of the virus and vaccine inequity (Mwai, 2021). Africa's average death rate was 2.6 per cent for many months, which was higher than the global average of 2.2 per cent. According to Mwai (2021), the Delta variant of COVID-19 has

been the cause of increased deaths and cases across the African continent and has been reported in more than seventeen countries by July 2021. The Delta variant cannot be tracked as easily and testing for this variant is not generally available. The South African variant, Beta, accumulated high case numbers and was detected in twenty-nine countries by July 2021. Mwai (2021) reported that thirty-two countries have identified a variant first identified in the United Kingdom, named Alpha.

The COVID-19 pandemic's effect on Africa's long-term development has been disastrous - almost a decade of human development has been erased as reported by the Institute for Security Studies (Timm, 2021). According to Mhlaba (2021), Statistics South Africa reported that 2.2 million jobs were irrecoverable due to the economic shutdown during the pandemic. Education has been challenged globally, forcing schools to carry on teaching with online methods and implementing rotational attendance. However, some students have not returned to school and many South African households have no access to the internet or computers (Mhlaba, 2021). Shepherd and Moholwane (2021) stated that 10 per cent of South African parents reported that a minimum of one child per household had not attended school since the pandemic started. South African learners from Grades 1 to 12 are estimated at 12 million, which means that almost 750,000 learners aged seven to seventeen have not been attending school by May 2021. This is an increase of ±500,000 learners, compared to before the pandemic. South African Minister of Basic Education, Angie Motshekga reported in November 2021 that approximately 300,000 learners withdrew from primary schools all over South Africa over the course of six months (Mhlaba, 2021). Shepherd and Moholwane (2021) mentioned that the rate of learning loss in 2020 and 2021 was similar, due to lost school days and rotational attendance. It has been calculated that since March 2020 and June 2021 most primary school learners lost upwards of 70 per cent to a year of schooling. Teacher fatalities during the first two waves of the pandemic amounted to 2,283 (0.57 per cent of the workforce) by May 2021. No clear association has been proven between schools being open and the virus spreading more quickly (Shepherd & Moholwane, 2021).

The academic year of 2021 proved extremely challenging for South African education, by virtue of the pandemic and infection rate of the Delta variant. The continued quarantine, economic challenges, uncertainty, loss and bereavement led to increased

anxiety regarding school attendance in South Africa (Silbert & Mzozoyana, 2021). The reopening of schools for 2021 was intended for 27 January, however, the second wave of the pandemic hit South Africa and Level 3 lockdown restrictions were imposed and were lifted on 28 February 2021. Schools reopened on 15 February and have stayed open since then, even though many learners continued school on a rotational basis (Shepherd & Moholwane, 2021). However, schools were closed for a week longer in July 2021, during the third wave of the pandemic under Extended Alert Level 4 lockdown (Shoba, 2021). Rotational learning continued, where learners attended school on different days and implemented social distancing. Concern has arisen that when learners return after two or three days, they might already have forgotten the work taught and lessons have to be repeated. This greatly impacts the learners' proficiency of key skills, namely reading amongst Grade 1 learners, who were not in school for one full term of teaching. Shoba (2021) mentioned the DBE's report that almost two decades of educational gains were erased by the pandemic, which includes educational time lost and that, as a result, 78 per cent of Grade 4 learners are now unable to read skilfully, as shown by school-based assessments.

Online learning has been a lifeline for some learners but is out of reach for most (Fricker & Alhattab, 2021). Landa, Zhou and Marongwe (2021) stated that teaching during emergencies like the COVID-19 pandemic relies on access to basic technology. *BusinessTech* (26 August 2021) reported that South Africa's internet access rate only stands at 64 per cent, which excludes 20 million citizens from accessing the internet and online teaching opportunities. On a global scale, the World Bank calculated that school closures impacted 1.6 billion learners. Learners from poorer communities were cut off from teaching during the school closures, since having technology for anything different from survival and acquiring crucial information was an extravagance at that time (Landa *et al.,* 2021).

A consequential percentage of South African learners live in rural areas, which was calculated at 66 per cent of the total learner population in 2019. The South African government faced challenges with delivering high-quality education to rural learners even before the onset of the pandemic, which only increased when online learning was imposed on teachers and learners (Landa *et al.,* 2021). During the pandemic, the government attempted to save the academic year by leaping into online and remote

learning, by collaborating with non-governmental organisations. Initiatives emerged focused on mobile, online and social media platforms, which included Zoom, Microsoft Teams and WhatsApp groups. Several mobile network providers provided access to zero-rated educational apps, which meant they did not use data and were essentially free (Landa *et al.,* 2021). However, the effect of the pandemic can already be seen by the 5 per cent decrease in Grade 12 pass rates. Learners were especially harmed in core content areas like mathematics and science - a study from the Telkom Foundation confirmed that the absence of classroom learning caused regression in high school learners (*BusinessTech* 26 August 2021). It is apparent that the calibre of education amid the ongoing COVID-19 pandemic was impacted by less interaction, lost days of teaching and a loss of teachers (Timm, 2021).

2.2.2 Electronic devices and types

Technology and electronic devices have developed rapidly in recent years, and most children are increasingly being exposed to these devices during early childhood (Oliemat, Ihmeideh & Alkhawaldeh, 2018:591). This era of technological development has enabled the use of electronic devices, including smartphones, computers, touchscreen tablets, TVs, and video gaming consoles by children of all ages (Oliemat *et al.,* 2018). Electronic devices form part of many children's' lives, however, these devices may have negative and positive impacts when used by children at a young age (Fitriahadi & Tyastiti, 2020). This section will explore the literature on smartphones, computers, touchscreen tablets, televisions, and video gaming consoles.

2.2.2.1 Smartphones

Cell phones developed into smartphones, which have enabled users to access a variety of applications, other than only making a basic phone call. Children begin experimenting and playing on their parents' phones as babies and toddlers (Brito & Dias, 2020). Golden, Blake and Giuliano (2020) mentioned previous studies that found that most infants had used smartphones before the age of one and that they are regularly preoccupied with smartphones under the supervision of their parents. Fitriahadi and Tyastiti (2020) found that children aged two to four spend two hours per day on smartphones. Internet access on smartphones has become more affordable,

which may have led to increased usage in children, adolescents and adults alike. Brito and Dias (2020) reported that the favourite applications of children include games, watching videos, music, tutorials and cartoons on YouTube. They also start to research their interests on the Google search engine and use the camera and related applications to draw on and edit photos. Kamenetz (2019) confirms that video viewing is a firm favourite among children aged eight to twelve in the US, who spend around 2.5 hours daily on YouTube. Piñon (2019) reported that 24 per cent of eight to twelve-year-old US children had smartphones in 2015. Kamenetz (2019) reported an increase to approximately 53 per cent of US children having their own smartphones before eleven-years of age in 2019, which means one in five (19 per cent) eight-year-olds have their own smartphone. Self-reported smartphone usage by these children totals almost five hours per day (Kamenetz, 2019).

Rich (2020) stated that screen content on smartphones has been made available to almost anyone, due to its compact size and touchscreen navigated service. This content includes educational applications, which aid in mathematics and language learning. These interactive applications are increasingly being used in schools to support the teaching and learning of core content and skills. Behnamnia, Kamsin and Ismail (2021) stated that those educational games may amplify the creativity of children while enhancing their learning, which leads to critical thinking, problem-solving and collaboration with others. Children experience satisfaction from smartphone usage, which increases their confidence when they finish tasks and succeed in higher levels of games (Fitriahadi & Tyastiti, 2020). Smartphones have other positive impacts, such as self-regulation, promotion of independence, and learning by actively doing or through trial and error. They entertain and enable children to discover their interests and socialise with others (Brito & Dias, 2020). According to Rich (2020), mixed results were reported when receptive and interactive learning on smartphone screens were compared: The performance of learners increased when tasks were repeated, but learners' working memory and attentional abilities may have been overwhelmed. Fitriahadi and Tyastiti (2020) stated that the increasingly widespread negative impacts of smartphone usage are visible when parental control is lacking. Smartphones may also impact the social behaviour and emotional intelligence of children and may then have a negative impact when addictive behaviour towards mobile games emerges. Excessive smartphone usage during childhood has

also been linked to reduced adolescent brain development, strained social relationships, increased anxiety, sleep impairment and risk of depression (Piñon, 2019). Smartphones may expose children to inappropriate content online, encourage sedentary behaviour and lead to inattention (Brito & Dias, 2020).

2.2.2.2 Computers

This era of rapid technological advancement has enabled children to become computer experts from a young age (Gerwin, Kaliebe & Daigle, 2018). A study in the US with 1,000 parents via telephone found that 27 per cent of children aged four to six use computers daily and that such usage has become an integral part of children's lives (Mustafaoğlu, Zirek, Yasacı & Özdinçler, 2018). Another study in the US by Mollborn and Fomby (2020) found that approximately 80 per cent of children aged nine to thirteen have access to computers. Computers and laptops (portable computers) are now linked to the internet and serve a multitude of purposes, such as consumption of media, creating, working, information seeking and learning (Mollborn & Fomby, 2020). Enthoven, Tideman, Polling, Verhoeven and Klaver (2019) found that computer usage by children increased from 0.31 to approximately 0.46 hours daily at age six, to 0.74 to approximately 0.79 hours by age nine. Mastering computers at a young age has enabled huge strides to be made in children's preparedness for schooling, careers and innovative thinking.

ICT (Information and Communication Technology) usage has increased in education and learning with 21st-century classrooms embracing the transformations resulting in an interactive and technologically advanced learning environment (Bagon, Gačnik & Starčič, 2018). Bagon *et al.* (2018) elaborated, saying that this learning environment was collaborative, flexible and socially connected. ICT in education is beneficial to cognitive development, literacy, motivation, communication and social skills. Learners share a belief that computer-related learning supports more productive learning conditions and is more interesting. Lupescu (2021) pointed out that computer usage enables learners to work more comfortably with documents and follow along with teachers' classes.

Computer usage is associated with raising the efficacy of independent work and increasing success. Learning with computers also provides opportunities to search for

information from various sources, while providing feedback on the learning process. Dunlap (2018) concurred by stating that academic software use in school leads to more progress. Interactive programmes support all learners in developing their strong points while improving weaker areas. Computer functions like email can improve learners' writing abilities and the internet can expand their worldview through the use of virtual tours to various destinations (Dunlap, 2018). However, it is paramount to mention that too much screen-time might impact academic performance negatively (Mustafaoğlu *et al.,* 2018). Children may experience fatigue in the form of nervousness, insomnia, irritability and a decrease in their attention span when they remain seated at a computer for extended periods (Lupescu, 2021).

2.2.2.3 Tablets

Touchscreen tablets have only been used widely for less than a decade and have increased in popularity as portable cellular devices with high-speed internet access (Mollborn & Fomby, 2020). Tablets offer application software and functionality similar to smartphones and computers - even preschool children have become users (Lin, 2019). Marsh, Lahmar, Ploughman, Yamada-Rice, Bishop and Scott (2020) found that six in ten children aged three to four in the UK use electronic devices to go online, while 49 per cent are using tablets for that purpose. An online survey of 198 parents of children younger than three revealed that a quarter of those children use touchscreen tablets daily for viewing cartoons, programmes and videos on YouTube. They also use tablets daily for mathematics, reading applications and easy games. Marsh *et al.* (2020), concluded that tablets are increasingly used by pre-schoolers due to their screen size, ease of use and portability. Lin (2019) mentions a survey of 1,500 parents with children younger than twelve, of which 10.4 per cent of those children younger than six own a tablet. Upwards of 20 per cent of those children use it for more than an hour daily and 67.6 per cent of them accessed tablets before age six. Tablets are increasingly incorporated into the school curricula worldwide. Oliemat *et al.* (2018) described that touch-based features and applications for tablets have become more affordable and are easily implemented in schools as an important learning tool, thus they are vastly improved, compared to the devices used previously. Numerous studies have reported that tablets can provide memorable learning experiences, which support development and learning (Oliemat *et al.*, 2018). Tablets encourage motivation and persistence in task completion and enhance learners' interest and determination when

completing tasks. Tablets help develop early literacy skills and second language acquisition. Learners are also able to do homework and conduct research on tablets (Oliemat *et al.*, 2018).

Trifunović, Čičević, Lazarević, Mitrović and Dragović (2018) pointed out that learners using tablets in pairs or with adults have increased motor skills, and better geometric and mathematical thinking, enhanced critical thinking and creativity when tested. Learners develop interaction, communication and cooperation skills when working with peers on tablets and even show positive attitudes towards learning. A study of tasks completed on computers versus tablets concluded that 67 per cent of learners had correct answers on tablets, and only 49 per cent had correct answers on a computer (Trifunović *et al.*, 2018:40). Ross (2020) mentioned that there are more than 15,000 educational applications available on the Apple App Store and the Google Play Store contains just as many. Tablets are also used by learners with special needs, with functions such as voice-to-text and dictated information (Ross, 2020).

Tablet usage may also be prolonged due to the entertainment factor and convenience of use. Lin (2019) stated that the rapid changes of scenes and various light simulations cause tired eye muscles, which have been associated with weak visual pursuit ability. Overuse can lead to less interaction with adults, attention deficits, and impaired 3D visual-spatial perception. Frequent tablet usage may detrimentally impact the fine motor development of learners when compared with physical manipulation and grasping of toys and objects (Lin, 2019). However, more research is needed to confirm this. Teachers have reported that tablets can be distracting in class with their ability to take you almost anywhere virtually (Ross, 2020).

2.2.2.4 Television sets

Televisions have been around the longest and a few channels focus exclusively on educational and informational content for children, such as Sesame Street (Gongala, 2021). Smart TV's enable the usage of applications like Netflix, Amazon Prime and YouTube (Thompson, 2020). Searches on YouTube empowers children to be their own teacher and pursue information about subjects they are intrigued by. Gongala (2021) asserts that educational channels offer subjects like science, history, art, mathematics and geography. Children are exposed to universal languages and different types of sports. Children are also inspired by documentaries and programmes

to attempt new things and discover more interests (Gongala, 2021). The types of programmes watched by children shape their attitudes and personalities and may influence their environmental and social awareness, and holistically promote cognitive, social and emotional development (Sabardila, Markhamah, Arifin, Kusmanto, Hidayah, Kurniasari & Saputro, 2021). Children's programmes teach a variety of skills, such as peer interaction, dealing with emotional trauma, navigating difficult situations and sparking the imagination through interactive quizzes. Some programmes like Sid the Science Kid, teach mathematics and problem-solving, alongside analytical thinking (Sabardila *et al.*, 2021).

Khanyile (2021) reports that South African children spend more than three hours daily in front of screens, which excludes school-related screen time. This information was stated in the 2018 Healthy Active Kids South Africa report, which also found that 94 per cent of babies and toddlers from urban and low-income households ignored the suggestion of no screen time for children younger than two (Khanyile, 2021). Tumbokon (2020) agreed by mentioning that no educational benefits are provided for children younger than two as it takes up time that could have been spent exploring, interacting and playing. Studies have shown that children with TVs in their bedrooms spend half an hour more on their TVs and are likely to be depressive, overweight, emotionally distressed, victimised, physically aggressive and have underdeveloped social skills by age thirteen (Tumbokon, 2020). Children bombarded by TV in the background at home experience difficulties concentrating on voices when background noise is present. This attention difficulty continues in school when learners are unable to pay attention to teachers. Therefore, an increase in TV decreases time spent talking to family members and learners struggle to adjust to aural learning, after being used to fast-paced visual stimulation on the TV. Tumbokon (2020) emphasised that less effective homework is completed with TV in the background and that learners in that type of environment retain less information. TV watching is also associated with less sleep, which decreases children's alertness and leads to poor school performance (Tumbokon, 2020).

2.2.2.5 Video gaming consoles

Video game consoles are multimedia devices providing fun and entertainment, on which one can perform many activities simultaneously. Gaming consoles have risen

in popularity, totalling 29.4 million worldwide shipments of PlayStation four consoles and Nintendo Switch totalling 34.74 million consoles by the end of 2017 (Griffith, 2019). Gregory (2020) stated that US spending on gaming consoles during 2020 increased by 63 per cent when compared to March 2019. Paswan (2020) confirmed that the video gaming industry is very popular among children and adults alike, due to its high-quality graphics, attractive audio and a colourful ambience. Gaming consoles contain applications such as Spotify, Hulu, Netflix and YouTube, and an app for playing Blu-Ray discs. Gaming consoles also enable video calling via Skype to connect with fellow gamers or family members, as well as function as an internet browser (Griffith, 2019).

Gaming consoles are associated with many benefits to children. Gregory (2020) stated that gaming consoles are emotionally, socially and motivationally beneficial. Children are able to socialise in teams online, while negotiating, taking turns, collaborating and thinking critically to reach goals. Video gaming has a therapeutic value for mental health, by creating a sense of agency and having a modicum of control over outcomes (Gregory, 2020). Video gaming on consoles can improve mood, lessen anxiety and enhance relaxation while building emotional resilience through failed attempts and learning to deal with losses (Brennan, 2021). Video gaming can boost reading skills since even young players have to figure out the instructions for gameplay. Games like Minecraft, which is set in a 3D world, develop visual-spatial skills, such as distance and space. Problem-solving skills are also improved through puzzles and mysteries to be solved, alongside flexible thinking and planning. Video gaming extends imaginative play and creative thinking, as well as persistence, to achieve goals in-games and in real life (Velez, 2021). Excessive usage of gaming consoles has been associated with concentration issues, which directly impact school performance (Paswan, 2020). Video gaming may lead to sleep disruption, addiction to gaming and violent behaviour such as aggression and irritability. In rare cases, when children are addicted to gaming, they become highly irritable, experience hallucinations and physical pain, and become at risk for obesity (Brennan, 2021). Paswan (2020) found that excessive video gaming may impact children's ability to differentiate between reality and fantasy, which results in nightmares. Children are exposed to violence in games if not monitored by parents; which may also impact their anger management (Paswan, 2020).

2.2.3 The social development of the learner

Social development during early childhood is regarded to be crucial in social competence (Carson, Lee, Hesketh, Hunter, Kuzik, Predy, Rhodes, Rinaldi, Spence & Hinkley, 2019). Social skills are classified as possessing the capability to develop positive relationships and interact with other people. Carson *et al*. (2019) described social skills as critical abilities that underlie social competence and development. Well-developed social skills in early childhood are associated with better school performance, mental health and future employment; as well as less substance abuse and criminal activity in adolescence and adulthood.

Malik and Marwaha (2020) concurred that children who fail to follow the trajectory of social development as is expected will experience emotional and mental health problems. Possible mental health issues manifest as compulsive behavioural activities, withdrawal and minimal interest in socialising, repeated impulsive and aggressive behaviour, struggling to play with peers, minimal or no communication, stunted language development, and even a loss of prior developmental achievements (Palmer, 2019). Children develop social skills through playing and interacting with siblings, peers, parents and others at home and in school settings (Carson *et al*., 2019).

During the initial years of childhood, children acquire social and emotional skills, including sharing, regulating emotions and following instructions. These skills form the foundation for developing numeracy, literacy and other cognitive abilities (Palmer, 2019). Palmer (2019) stated that children experience healthy social development when they have responsive and nurturing relationships with family members and caregivers. Social development is crucial during early childhood, when children's brains are developing swiftly, including their capability to learn crucial social skills. Palmer (2019) advocated that social and emotional development is affected by experiences and genetics, and together they form the architecture of the brain. Children's experiences of interactions and the environment lay a strong or weak foundation, depending on the quality of these experiences (Palmer, 2019).

Social development plays a meaningful role in school readiness, which refers to the preparedness of children to be successful in a structured learning environment (Graham, 2020). Social and emotional learning (SEL) is essential for school readiness

and a predictor of academic success. The process of SEL includes setting and achieving positive goals, managing and understanding emotions, forming and maintaining relationships, and making responsible decisions. Social development involves experimental learning and the refining of social skills (Graham, 2020).

Kalish (2019) also found that SEL enhances academic achievement and helps prevent violent behaviour and mental health issues. Social and emotional competence enables children to become self-aware, confident and manage their impulses, which leads to behavioural improvements and academic achievement. A vital SEL skill is motivation, which encompasses the achievement of goals through utilising emotional factors, persevering when faced with obstacles and enjoying the learning process (Kalish, 2019).

ECE is full of opportunities for learners to build and practise their social skills (Palmer, 2019). The ECE environment should provide quality experiences since it directly impacts the degree to which children develop socially and emotionally. A high-quality environment is defined as one with warm, frequent and stimulating interactions with educators and peers, with educators being attentive to the needs of individual learners and building on the strengths of learners. Palmer (2019) advocated that early childhood teachers are trained to identify barriers to social and emotional development and can provide families with advice and support to address these barriers. Irshad, Maan, Batool and Hanif (2021) agreed that ECE is a crucial foundation for children's social competence, as well as educational and cognitive future development.

Early childhood educators must provide learners with assistance and guidance to accelerate holistic development. Early childhood educators know social developmental milestones and use them as a guideline for interventions (Search Institute, 2018). During primary school years, learners start paying more attention to others around them, while comparing themselves to peers and attempting to fit in. Learners become more selective when choosing friends and start to make judgements about others' actions. Learners that are aged six to seven are seen with one friend, while learners aged eight to nine could have many best friends. Learners show more interest in the differences between girls and boys (Search Institute, 2018). Learners regularly want to play with same-gender peers, which is sometimes challenging for children still developing gender identity. Learners also become aware of pre-existing

stereotypes, biases and rejection based on gender, race, weight and age, even more so when they experience these biases (Search Institute, 2018). Early childhood development of social skills is therefore crucial to ensuring optimal brain development and social competence, to increase future academic achievement and holistic development (Kalish, 2019; Graham, 2020).

2.2.4 Cognitive development of the learner

Early childhood is a time for playing, blending fiction and facts, and learning to use language to think about the world (Loalada, 2021). Sagar (2019) describes cognitive development as the ability to explore, think and understand. Early experiences form new connections in the brain. The quantity and quality of these experiences impact the strength of the synapses (brain connections) (Lang, 2019). Cognitive development is enhanced when learners are healthy, socially connected, and emotionally secure. The advancement of knowledge and problem-solving capabilities increases children's ability to understand the world. These skills are crucial for sensory processing and learning new things, which begin in early childhood and improve with support and practice. Crucial cognitive skills include language learning, attention, memory, processing, reasoning, solving problems, thinking, pattern recognition, and cause and effect (Sagar, 2019).

Jean Piaget's cognitive development theory is regarded as the most comprehensive (Sagar, 2019). Piaget found that children continuously try to balance the way they understand the world. When children are faced with new things, they will assimilate them into their existing schema and match them with something already known, or they will accommodate the new situation by expanding their knowledge structures (Loalada, 2021). During school age years complex cognitive skills are developed, which carries learners through school and prepares them for learning as adolescents and adults. These complex skills include problem-solving, reasoning (complex and novel problem-solving), symbolic thought and working memory (manipulating and storing information simultaneously) development (Lang, 2019; Peng & Kievit, 2020). Peng and Kievit (2020) add executive functioning to the list, which encompasses the processes behind cognitive and social-emotional goal-oriented behaviours that lead to self-control, self-regulation, and flexible thinking.

Piaget advocates that the cognitive development process occurs when children interact with the world (Lang, 2019). Primary school learners (aged between seven and eleven) form part of Piaget's concrete operational stage of cognitive development, during which learners transition from symbolic thinking to logical operational thinking. They begin to process ideas and thoughts internally (Lang, 2019). During this stage learners start thinking logically about events occurring concretely; the concept of conservation is developing regarding change of shape and how certain properties remain; learners can reverse things mentally (return objects to their original shape); learners become less egocentric and begin to consider other people's feelings and thoughts (McLeod, 2021).

Primary school settings are structured, enabling opportunities to explore interests, connect with others, discover new skills, and use new knowledge in interesting ways, with enough time and space to process learning (Lang, 2019). Cognitive learning is described as an active learning style, which maximises the brain's potential to connect new information with existing schemas and increases retention and memory capacity (Valamis, 2021). Components of cognitive learning include comprehension, memory, and application. Learners have to understand why different subjects are learnt, which increases learning efficiency. In terms of memory, information should not be crammed, but a deep understanding of a subject should be encouraged. This increases a child's ability to relate previous life experiences with new information. Cognitive learning strategies help learners to apply new skills and information in real life situations and support the development of problem-solving skills (Valamis, 2021). Cognitive learning has shown many benefits, as claimed by Valamis (2021). It leads to lifelong learning, where learners can continue building on previous knowledge and apply new ideas.

Cognitive learning encourages learners' confidence in approaching new activities, by deepening their understanding of subjects and practising new skills. Problem-solving skills are enhanced through cognitive learning, which is necessary when challenging tasks are attempted. Comprehension of new information is also improved by deepening understanding of subjects and materials (Valamis, 2021). Piaget summarised cognitive learning strategies of learners as accommodation (modifying what is known to account for new information), assimilation (arranging new information

in their minds alongside what is known), and equilibration (balancing what is known with what they are attempting to acquire) (Valamis, 2021).

The University of Michigan Health (2021) listed several cognitive development milestones for primary school learners. Learners aged seven should be able to have a stable understanding of time, grasping seconds, minutes, hours, days, weeks, months, seasons and even years. They prefer specific learning styles, such as quiet and independent or hands-on. Learners can solve simple mathematics problems concretely, by using objects. They can consider problems and issues focusing on a single factor at a time (University of Michigan Health, 2020). Learners aged eight should manage to skip count in twos and threes. They understand which day of the week it is, though they may not know the calendar date. Learners can read basic sentences and complete single-digit addition and subtraction sums. Learners can differentiate between left and right. Most of the time, these learners have a black or white perspective, where something is either right or wrong, beautiful or ugly (University of Michigan Health, 2020). Learners should have ample opportunities to ask questions, explore and learn by observing in primary school. Focusing on cognitive skills is crucial in early childhood, to enable early detection of challenges or delays and empower educators to address these issues, which can prevent learners from struggling later in life (Sagar, 2019).

2.3 Theoretical framework – Albert Bandura's (SCT) Social Cognitive Theory

The SCT was created by Albert Bandura, a renowned professor of psychology at Stanford University (Vinney, 2019). Behavioural theories initially suggested that all learning took place due to associations formed through conditioning, reinforcement and punishment. Bandura believed that behavioural development had an important social element and that people learn through observing others' actions to gain new knowledge and then can adjust their behaviour (Bandura, 1971; Cherry, 2021). Bandura, therefore, performed an array of experiments in 1961 and 1963, to ascertain if a social behaviour such as aggression can be accrued through observation and imitation.

The experiments, named the Bobo doll experiments, entailed children observing a model hitting an inflatable doll and Bandura proved that children emulate behaviour

that they observed from others (Bandura, Ross & Ross, 1961). Bandura popularized the Social Learning Theory in 1977, which defined his perspective on learning through observation and motivation. Observational learning could explain various behaviours not accounted for in existing theories (Bandura, 1971; Cherry, 2021). Bandura adapted his theory to become the Social Cognitive Theory (SCT) in 1986, to assert the cognitive aspects of observational learning and to show how cognition, behaviour and the environment collaborate to shape the development of humans (Bandura, 1989; Vinney, 2019). The social aspect of the theory recognises the social origins of most human action and thought, whereas the cognitive aspect acknowledges the impactful causal contribution of human thought, which then affects motivation and action (Bandura, 1989; Beauchamp, Crawford & Jackson, 2019).

The core concepts of SCT include learning through observation and the internal mental state of a person is crucial to the process. This theory acknowledges that just because learning took place, that does not automatically result in a behaviour change. Bandura asserted that most human behaviour is learnt through observing the behaviour of a model, which suggests how new and different behaviours are recreated. These observations are coded in the brain and may guide behaviour on later occasions (Bandura, 1989; Cherry, 2021).

Various factors influence a person's ability to learn and perform new behaviours. External forces and internal thoughts influence the cognitive learning process. Behaviour and learning are therefore impacted by things seen in the environment, social interactions, observed behaviours and how they are interpreted (Bandura, 1989). The SCT, therefore, describes the process of learning in a social context, which involves personal factors (cognition), environmental factors and human behaviour that influence one another and is also referred to as triadic reciprocal determinism (Bandura, 1989; Beauchamp, Crawford & Jackson, 2019). The SCT encompasses several key assumptions. People acquire new behaviours and knowledge through observation of a model (Bandura, 1989). Learning happens in social situations, through compelling mutual interaction between the environment, the behaviour and the person (Bandura, 1989; LaMorte, 2019). Reinforcement and punishment directly impact learning and behaviour – humans develop expectations about possible consequences of responses in the future, based on the reinforcement or punishment

of current responses. Cognitive factors influence whether behaviour is acquired or not, while mediational processes impact behavioural development (Bandura, 1989). Past experiences are taken into account, to determine if a certain behavioural action will occur (Bandura, 1989; LaMorte, 2019).

Observational learning makes use of three types of models. Live models are real life individuals acting out or demonstrating a behaviour. Symbolic models are characters portraying behaviours in films, books, online media and TV programmes. Verbal instructional models include explanations and descriptions of behaviours (Bandura, 1989; Cherry, 2021; Williams, 2018). Observational learning follows a sequence of four processes (Bandura, 1989; Vinney, 2019). Attentional processes highlight the information selected in education for observation, through the various types of models. Retention processes follow, where learners remember the observed behaviour and information, to be recalled and reconstructed successfully at a later stage. Production processes encompass the reconstruction of the memories of observations, to apply it in appropriate situations. In some cases, the observed action will not be precisely replicated but instead is modified to produce a variation of the behaviour fitting the context. Motivational processes determine if observed behaviour is performed, based on the outcomes for the model. When the observed behaviour is rewarded, motivation to reproduce it later increases (Bandura, 1989; Vinney, 2019). It is also noteworthy that good role models are essential, whereas poor role models have a corrosive influence on observational learning (Williams, 2018).

The COVID-19 pandemic impacted education since 2020 in South Africa, which mandated working and learning from home during school closures. Many learners completed schoolwork on online learning platforms, while others had no access to online resources. Many parents complained that they were busy with work at home or were unsure of how to teach online work to learners. Beauchamp *et al.* (2019) declared that daily activities and tasks are rarely performed in isolation and are usually done in interdependent and social settings. People are dependent on proxy agents to support the achievement of objectives and goals. SCT helps us to understand how people are influenced and how they also impact the environment (Valamis, 2021). Through observational learning, learners can acquire new knowledge quickly when they take individual responsibility and act. Teachers, peers and parents are all active models

who support the development of social and cognitive skills through direct and indirect teaching (Valamis, 2021). Teachers use multisensory approaches in a classroom, which requires various activities (verbal, visual, tactile and kinaesthetic) when learners are acquiring a new skill; and it improves retention (Fullbrook, 2021). Teachers also use peer and group work when teaching new skills. Group work is beneficial to learners. Higher ability learners are grouped with struggling learners, who support and coach each other.

Learners pay more attention to their peers, than when a teacher presents a lesson (Fullbrook, 2021). Less motivated learners are also paired with highly motivated learners, which increases their learning motivation. Learners' motivation can be intrinsic or extrinsic; the latter being the case when other learners are rewarded for the same behaviour. Motivation also increases learners' self-efficacy, which occurs when they are verbally persuaded and receive constructive feedback. When learners develop confidence and a belief in their own abilities, they will try harder to succeed (Fullbrook, 2021). SCT as theoretical framework will enable the researcher to determine how parents as models for social and cognitive learning impacted the development of learners during the COVID-19 pandemic. The researcher will also determine how the school closures and online learning impacted the social and cognitive development of the learners, who had far less school contact time with teachers and peers and were dependent on online learning, with the assistance of their parents.

Adolt-Silva (2021) conducted a study focusing on how executive functioning skills are not taught often to learners with Attention-deficit/hyperactivity disorder (ADHD) or learning disabilities in art classrooms in Pennsylvania in the US. Adolt-Silva (2021) believed that teaching should include environmental models and support relationships in various modalities adaptable to each child. This supports the learning of skills inclusive of self-regulation, perspective taking, self-control, communication, taking on challenges, making connections and problem-solving. Adolt-Silva (2021) implemented Bandura's SCT as the study framework; specifically, the dynamic reciprocal determinism concept (the interdependence of the environment, past experiences and reciprocal interactions between people). Adolt-Silva (2021) used a qualitative design

and interviewed eight art teachers regarding their teaching practice and teaching of executive functioning skills.

SCT as a framework was applied successfully and Adolt-Silva (2021) found that many teachers were implementing strategies that encouraged the development of executive functioning skills through planning and scaffolding. However, teachers felt that they needed professional standards and requirements for teaching these skills. Teachers embraced the triadic approach in daily classroom activities, which empowered learners with ADHD or learning disabilities to learn executive functioning skills through art. Adolt-Silva (2021) used the information from the teachers to create a three-day professional practice-based, development programme. Arundell, Parker, Timperio, Salmon and Veitch (2020) conducted a study in Australia on the major public health concern that arose from excessive screen time behaviours of parents and children at home. Arundell aimed to discover if parents' and children's screen time behaviours clustered together and to understand the correlates of the familial clusters, which would help to inform whole-family intervention strategies. The study, framed by SCT, categorised familial typologies and detected the essential adaptable correlates of the familial typologies. Parents reported the duration of screen time behaviours of their children (aged two to eleven) and themselves on devices like TV's, electronic games, computers, tablets and smartphones for work and leisure.

Arundell *et al.* (2020) achieved success in identifying three familial typologies of screen time behaviours. Arundell emphasised that screen time behaviours can be affected by parental behaviours, the household setup, child preferences, role models and school policies. Rahman and Farzana (2019) conducted a study on children growing up with multiple digital media devices within households. Rahman and Farzana (2019) stated that children and parents spend a substantial amount of time on digital devices. Children are inclined to copy their parents, to view, imitate and also learn from their behaviours. The researchers conducted a quantitative analysis of data from 87 parents from Bangladesh and Thailand, to determine if there is a relationship between device usage by children and parents. Rahman and Farzana (2019) found a statistically strong significant relationship between a parent's extent of device usage, the child's device usage and age group. The findings were consistent with SCT, emphasising that children learn by observing, imitating, and modelling.

Wong, Tung, Rao, Leung, Hui, Tso, Fu, Jiang, Zhao and Ip (2020) conducted a study aiming at disentangling the pathways of parental device usage, parent-child interaction, children's screen time behaviours and children's psychosocial difficulties of families in Hong Kong who are disadvantaged. Parents of children aged three reported on how many hours their children spent on electronic devices daily and evaluated the psychosocial behaviour of their children with the strengths and weaknesses questionnaire. Parents self-reported on their device usage and the occurrence of parent-child interaction. Wong *et al.* (2020) found that children may subsequently learn and imitate modelled screen time behaviours of parents. Parents become distracted by electronic devices in front of their children, which links parental device usage to children's screen time behaviours. Wong *et al.* (2020) reported that these parents often engage in device usage during interaction with their children. The study proved the hypothesis that children's device usage behaviours can be learned from parents, which reflects the key aspect of SCT stressing the importance of modelling and observation during the learning process.

In this study, the focus is on the impact of electronic device usage on the social and cognitive development of Grade 3 (previously referred to as Grade 2) learners during the COVID-19 pandemic. Previous research has associated positive and negative impacts of electronic devices on children. The SCT as a framework will guide the questionnaires that parents, teachers and learners will complete. Parents will report on their own electronic device usage, as well as their children's screen time, which will show if learners' screen-time is closely linked with that of parents. Learners had to complete online work, without modelling and guidance from teachers and peers, which may have impacted their social and cognitive development. Some parents were too busy with their own work or were uncertain of how they could support their children with online work, while some did not complete online work at all. Teachers are able to provide information regarding the social development of learners by having continuously observed these learners' social interactions during the 2022 school year. Cognitive development with regards to mathematics is a social activity in the Foundation Phase, where all new skills are taught in small groups, where modelling of the new skills takes place and learners are supported and motivated to imitate and retain the new skills. This study, therefore, highlights the observational learning of SCT, which includes attention, retention, production and motivation (Vinney, 2019).

2.4 Review of related empirical studies

The ongoing COVID-19 pandemic has posed huge challenges to education and childhood development worldwide (Daniel, 2020). This section of the study will review related empirical studies on the usage of electronic devices by learners during the COVID-19 pandemic, followed by the impact of electronic devices on learners' social and cognitive development. This section will conclude with a review of the strategies suggested by studies to mitigate the effect of electronic devices on learners.

2.4.1 Usage of electronic devices by the learners during the COVID-19 pandemic

Since April 2020, more than three billion people have been sheltering at home worldwide (Wiederhold, 2020). Upwards of 130 countries imposed restrictions limiting the movement of their citizens in an attempt to avert the spreading of the COVID-19 virus. Wiederhold (2020) stated that 90 per cent of learners were cut off physically from schools, while technology became a lifeline for learners to interact with friends, play and access educational content. Screen time has been increasing even before the COVID-19 break-out. Wiederhold (2020) referenced a 2019 report from Common Sense Media which determined that learners aged eight to twelve in the US use electronic devices for entertainment purposes for approximately five hours per day, excluding educational usage. Learners' device usage has skyrocketed and doubled those numbers with the lack of in person interactions during the pandemic. Wiederhold (2020) reported that learners of all ages spend approximately three hours daily on electronic devices, which has increased to six hours daily. The real number is even higher for many learners, prompting concern regarding the potential detrimental impact of excessive screen time on learners. The increase in device usage may be necessary for online learning, social interaction, entertainment and distraction in these uncertain times, which allow their parents to work from home (Wiederhold, 2020).

Wiederhold (2020) highlighted that the American Academy of Paediatrics (AAP) even suggested that screen time rules should be rethought in light of COVID-19. The AAP encouraged focusing on the screen time type, instead of the length of usage, such as using video calling to keep in touch with people. Dray (2020) reported that the UK government identified excessive device usage by learners as an increasing concern in April 2019. Since then, lockdown measures have driven learners to participate in

online learning and social media to stay connected. Dray (2020) also mentioned the survey carried out in 2019 by Census Wide on 2000 families with children aged below fourteen, which found that children spend approximately twenty-three hours weekly on electronic devices. Pandya and Lodha (2020) concurred that the pandemic has established online teaching as the sole medium for social-emotional interactions and connection and referred to a study done by Forbes, which reported a 50 to 70 per cent increase in internet usage daily during the pandemic - 50 per cent thereof was spent on social media in 2020.

A study was done in Germany by Wunsch, Nigg, Niessner, Schmidt, Oriwol, Hanssen-Doose, Burchartz, Eichsteller, Kolb, Worth and Woll (2021) found that screen time heightened naturally during the pandemic since adults and learners were required to use electronic devices for communication, mainly for online meetings and educational purposes. Normal daily lives were now transferred to an online environment. Wunsch *et al*. (2021) stated that the German School Barometer study, in which 1000 teachers completed a survey during the first lockdown period in 2020.

The study found that 84 per cent of teachers used task sheets for teaching during the lockdown period, while only 14 per cent used video conferencing. Wunsch *et al.* (2021) conducted a longitudinal observational study of 1,711 children aged four to seventeen, with multi-stage sampling. Parents of learners under age eleven filled in the questionnaires on behalf of their children. Wunsch *et al.* (2021) noted that pre-pandemic electronic device usage by learners was directly related to heightened screen time during the pandemic and less physical activity. The study's main limitation was its use of self-reported surveys, which may be influenced by the social desirability of answers and wanting to answer in ways that do not reflect negatively on the participant (Wunsch *et al.,* 2021). Dutta, Mukherjee, Sen and Sahu (2020) studied the impact of the lockdown in India on screen time and sleep behaviour. The researchers referred to a study by a non-governmental organisation, Child Rights and You (CRY), which reported that 88 per cent of participants experienced a tremendous increase in screen time of urban children in India. Dutta *et al*. (2020) conducted an online survey via email links and social media, to determine if screen time has detrimental effects on children aged eight to sixteen. Dutta *et al*. (2020) found that screen time did not increase with a high percentage of the 153 participants before and during the

pandemic. Increases of usage were reported as smartphones at 14 per cent, TV's 4 per cent, computers at 9 per cent and tablets at 2 per cent. The study limitations were the number of participants and the lack of information about sleep disturbances pre-pandemic. More participants could provide more conclusive results (Dutta *et al*. 2020).

Xiang, Zhang and Kuwahara (2020) studied the total time on screens of children and adolescents spent on internet use, leisure (TV and videos), computer/smartphone games, reading/studying online, homework, school lessons and social media use. The study took place in Shanghai, China and was a natural experimental longitudinal study of 2427 children aged six to seventeen, from five schools with two surveys. Screen time was categorised into short (less than two hours daily) and long (more than two hours daily). Xiang *et al.* (2020) found that the physical activity of participants decreased substantially from nine hours per week pre-pandemic to 1.75 hours per week, which is a decrease of 435 minutes on average. Physically inactive children became increasingly prevalent, from 21.3 per cent to 65.6 per cent. Xiang *et al.* (2020) concluded that screen time increased considerably amid the pandemic averaging 1,730 minutes/30 hours weekly, while leisure screen time also increased.

Lau and Lee (2021) conducted a study in Hong Kong, inspired by the school closures amid the pandemic. Teachers had to adapt the curriculum for distance learning to reach learners at home, who in turn needed parental support to participate in distance learning. Lau and Lee (2021) were concerned that learners were at risk for excessive electronic device usage during suspended classes, which may be detrimental to their development. The researchers used convenience sampling of 6707 kindergarten and primary school learners' parents in an anonymous online survey. Lau and Lee (2021) found that 98.8 per cent of primary school learners had to do distance learning during class suspension and received two to four assignments daily, of which 83.8 per cent were online (pre-recorded materials and other online platforms). Only 14 per cent of the learners were able to complete the online assignments without the help of their parents. Lau and Lee (2021) also reported that 75.7 per cent of learners used electronic devices excessively - the primary school learners (40.2 per cent) spent over two hours in front of screens for online assignments. More than half of the primary school learners (20.7 per cent) used electronic devices for two to three hours, closely followed by the 18.4 per cent of learners who used electronic devices for three to four

hours (Lau & Lee, 2021). The limitations include conducting the research in the early stages of the pandemic and only capturing the duration of screen time (not the nature or type) (Lau & Lee, 2021). The answers of participants may also be subjected to self-report bias and social desirability of answers.

Kovacs, Starc; Brandes, Kaj, Blagus, Leskošek, Suesse, Dinya, Guinhouya, Zito, Rocha, Gonzalez, Kontsevaya, Brzezinski, Bidiugan, Kiraly, Csányi and Okely (2021) conducted a multi-national, cross-sectional study in Spain, Germany, Russia, Italy and France. The study was inspired by the COVID-19 pandemic in Europe and how screen time and physical activity were affected by the restrictions, to inform adequate strategies and mitigation measures. Convenience sampling was implemented with an online survey from May to June 2020 of learners aged six to eighteen. Kovacs *et al.* (2021) used the AAP recommendation of a maximum of two hours of daily screen time as a baseline. Kovacs *et al.* (2021) found that 70 per cent of the participants exceeded two hours of screen time daily on weekdays, while almost 66 per cent exceeded screen time on weekends. Kovacs *et al.* (2021) suggested that insufficient physical activity and excessive electronic device usage are predictive of health issues and future strategies for mitigation should be designed to avoid the higher amount of screen time becoming the norm. The limitations of the study were the self-and parent-reported surveys, which may be subjected to bias in recalling and social desirability, as well as the fact that recreational screen time was not reported (only educational time) (Kovacs *et al.,* 2021).

Tough and Madigan (2021) were concerned that existing research was limited to cross-sectional studies or used the national norms for the comparison of data. The researchers, therefore, conducted a study on how the pandemic increased recreational screen time prior to the pandemic and which COVID-19 media-related and population factors influenced the immensity of heightened screen time among learners. Tough and Madigan (2021) conducted a study on the recreational screen time of 1333 mothers and their children aged five to nine in Calgary, Canada. The findings showed that COVID-19 screen time increased by 95 per cent, to approximately 23.57 hours weekly, which is an increase of eleven hours on average. Mothers who imposed screen time rules and were aware of their children's screen time activities reported less of an increase in screen time of their children, using electronic

devices 3.5 hours per week. Tough and Madigan (2021) also found that families struggling financially and experiencing psychological stress reported the highest elevation in screen time. The study had a few limitations, such as not addressing if the increased screen time puts children at risk, not enough detail regarding media types and context of screen time (co-viewing or educational) and what health outcomes are impacted by electronic device usage (Tough & Madigan, 2021).

2.4.2 Impact of the usage of different electronic devices on learners' social development

The effects of electronic device usage on young children have become a concern, especially how it interrupts parent-child interactions and causes disrupted relationships (Gerwin *et al.,* 2018). Schleisinger, Hirsh-Pasek and Golinkoff (2018) stated that 98 per cent of American households with children aged two to eight have mobile devices, which is an increase from 75 per cent in 2013, of which 45 per cent have their own mobile devices. Schleisinger *et al.* (2018) noted that research is accumulating on how social interactions drastically change when children come into contact with electronic devices. The main concern is that electronic devices are designed for solo activities, which decreases social interaction with parents eager for interaction.

Books traditionally supported social interactions, motivating learners to ask questions and connect to life experiences. In contrast, electronic books discourage conversations, since they interrupt the audio narration and thereby obliterate social interactions. The conversations that take place when interacting with electronic books are more focused on how to manipulate the devices and distract the children from the story, which results in weaker listening comprehension of children aged two to five when compared to reading traditional books with parents (Schleisinger *et al.*, 2018). Electronic games require the continuous attention of children and displace communication with caregivers almost completely when compared to normal play of children aged four to six with parents. Schleisinger *et al.* (2018) concluded that research is just beginning on using mobile devices and their effect on social interactions and more studies are required to comprehend the effects long-term.

The American College of Paediatricians (2020) studied a national sample of 40,337 children aged two to seventeen in 2016 and evaluated their usage of electronic

devices. The ACP found that children exposed to electronic devices for more than one hour daily showed less curiosity, more difficulty making friends, lower psychological well-being, lower self-control, less emotional stability and are difficult to care for. The American College of Paediatricians (2020) then conducted a meta-analysis of existing studies and referenced a study in Denmark on the relationship between depression and excessive electronic device usage. The longitudinal study followed a cohort of 435 adolescents into adulthood and found that every additional hour of electronic device usage is associated with greater chances of depression and anxiety that lead to social isolation. Another study of 300 learners found that smartphones that are close to learners on a table decrease the attention of learners during social interactions. This distraction leads to less enjoyment of social interactions (Dwyer, Kushlev & Dunn, 2018).

The American College of Paediatricians (2020) noted that various studies have linked TV viewing violence with future aggressive behaviours. One study was done on Grade 3 learners and their teachers and found that media violence exposure leads to more verbally and physically aggressive behaviour. The ACP stated that violence is shown frequently in various media sources in manners that reinforce aggressive behaviour as realistic, without consequences and justifiable. The American College of Paediatricians (2020) points out that even parents of toddlers use smartphone games to entertain their children, who in turn start to act with aggression towards others, show decreased empathy, interpret the behaviour of others negatively, respond with violence when confronted and are less prosocial. The American College of Paediatricians (2020) found that upwards of 85 per cent of video games contain violence, which lessens children's ability to comprehend others' emotions and decreases children's sensitivity to emotional cues. In person social interactions are displaced by screens, which leads to a reduction in social skills (The American College of Paediatricians, 2020).

Matthes, Thomas, Stevic and Schmuck (2021) noticed that parents expect excessive electronic devices used to have negative effects on family relationships and social development. Smartphones have fostered tension between children and parents since smartphones are perpetually accompanying children and causing conflicts with parents. Matthes *et al*. (2021) aimed to determine if parents' smartphone usage

impacted their inability to control their children's usage of smartphones and if it is linked to conflict. Matthes *et al*. (2021) conducted a two-wave panel survey with pairs of parents and children aged ten to fourteen and took a quota sample based on gender, age and education of parents. Matthes *et al*. (2021) found that excessive smartphone use by parents directly predicts the anticipated inadequacy of parental control over the usage of smartphones by children. This lack of control also predicted conflict between children and parents regarding how children use smartphones. The study was limited by self-report measures and memory recall biases (Matthes *et al*., 2021).

Ralph (2018) conducted an empirical case study in Canada on prosocial sharing behaviour when engaging with electronic devices, in this case, iPads. The study was framed by social learning and social exchange theories. Ralph (2018) implemented a mixed methods design with video ethnography. A field-study group of three preschool children aged four and one teacher was selected. Results showed that prosocial behaviours were more frequent than antisocial behaviours. The negative social behaviours comprised only 2 per cent of all behaviours. Ralph (2018) noticed possible negative impacts of iPad sharing, such as the occurrence of bullying. However, the teacher's presence reduced such behaviour and would have intervened. The activities on the iPad could be too fast-paced, distracting or overstimulating, but the researcher selected activities appropriate to the attention span of the learners. The limitations included generalizability, sample size and the time frame for the study. Many parents were uncomfortable with the video recording, which resulted in the small sample size (Ralph, 2018).

Hosokawa and Katsura (2018) conducted a study in Japan to determine the association between the usage of mobile devices and child regulation. The researchers sampled 1,642 learners aged 6 in Grade 1 in primary schools. Parents participated in a questionnaire on the emotional behavioural adjustment and learners' usage of mobile devices. Hosokawa and Katsura (2018) found that 14 per cent of learners used mobile devices daily for a minimum of 60 minutes. This regular of electronic device usage is greatly linked to behaviour and conduct issues. Hosokawa and Katsura (2018) reported that constant electronic device usage may increase the social isolation of learners and displace opportunities for social interaction with friends and family, which are beneficial for social development. This displacement results in

social and emotional behavioural issues, based on previous reports that showed more than half of computer usage at home is spent alone. Hosokawa and Katsura (2018) stated that constant electronic device usage is associated with children externalising problems, especially when exposed to violent programmes and games. The study had a few limitations. The cross-sectional design posed difficulties with ascertaining causality - a longitudinal design would be more appropriate. The study had a selection bias risk since unobservable factors influencing learners' electronic device usage could not be considered. The study did not include the context of device usage and may lack generalizability (Hosokawa & Katsura, 2018).

Hinkley, Brown, Carson and Teychenne (2018) studied the potential connections between physical activity outdoors and screen-time with social skills of children up to age five. Hinkley *et al.* (2018) collected cross-sectional data from 575 mothers of children aged two to five with an online questionnaire. Hinkley *et al.* (2018) reported that higher screen time levels and lower physical activity were associated with weaker social skills. The limitations are the cross-sectional design, no specification of electronic devices, and the online survey may not be generalisable to the population (Hinkley *et al.*, 2018).

2.4.3 Impact of the usage of different electronic devices on learners' cognitive development

Empirical research on the effect of electronic devices on the cognitive development of learners is gaining popularity, enabling literature reviews by various researchers (Gottschalk, 2019). Danovitch (2019) reviewed electronic device usage and understanding of children up to eight years of age. Danovitch (2019) noticed that many researchers believe that extensive access to electronic devices and the internet decreases cognitive capacity and intelligence. Individuals looking for answers are now turning to electronic devices and spend less time learning from other people. However, the empirical evidence on the effects of internet-accessible devices on cognitive development is inconclusive and outcomes are inconsistent. Danovitch (2019) added that children could feel less obligated to recall information since they can search for it on electronic devices. This may lead to a delay in the development of essential organisational and recollection strategies.

Chetty-Mhlanga, Fuhrimann, Eeftens, Basera, Hartinger, Dalvie and Röösli (2020) investigated the pervasiveness of various facets of electronic device usage and their correlation with neurocognitive outcomes in the rural sections of South Africa. A cohort study on learners aged nine to sixteen collected data with a questionnaire on total screen time, the duration of calls and problematic electronic device usage. The study by Chetty-Mhlanga *et al.* (2020) was one of the first done in Africa that focused on the risks and benefits of electronic device usage. Chetty-Mhlanga *et al.* (2020) found that smartphone usage increased alongside age, from 29 per cent aged nine to eleven to 35 per cent at ages twelve to fourteen. Chetty-Mhlanga *et al.* (2020) proclaim that the high dosage of radiofrequency electromagnetic fields from electronic devices to the brain, could impair cognitive function and weaken memory. The cross-sectional design of the study is a limitation and may need continuing analyses to be able to rule out reverse causality (Chetty-Mhlanga *et al.*, 2020).

Blumberg, Deater-Deckard, Calvert, Flynn, Green, Arnold and Brooks (2019) noted the necessity of examining electronic gameplay and application usage as a context for developing cognitive skills, especially for learners aged six to twelve in middle childhood. Blumberg *et al.* (2019) noticed the gap in studies of children aged six to twelve and how electronic devices impact them when compared with studies on adults and younger children. Blumberg *et al.* (2019) attempted to highlight the current empirical evidence on young children, middle childhood and adults. Blumberg *et al.* (2019) found that the impact of electronic devices depends on the content of TV programmes. Studies have found positive long-term associations and increased academic performance in science, mathematics and English. However, exposure to TV containing violence and purely for entertainment is associated with negative impacts on cognitive development. Blumberg *et al.* (2019) point out that learners can learn basic coding skills like sequencing, loops and conditioning by using developmentally relevant applications and improve in issuing certain commands with regular practice. Educational games of high quality substantially support mathematical skills and emerging literacy. Blumberg *et al.* (2019) also mentioned that electronic games can strengthen various key cognitive abilities, including selective attention, which are crucial to acquiring academic skills and information.

Vedechkina and Borgonovi (2021) reviewed the literature on the implications of electronic device usage (video games, TV and digital multitasking) on cognitive control and attention. Vedechkina and Borgonovi (2021) found that constant multitasking could interfere with the development of executive function and attention networks, which increase attentional difficulties and the vulnerability to switch tasks over having sustained focus on one task. Vedechkina and Borgonovi (2021) argued that most of the literature on TV viewing is of low quality and includes mainly cross-sectional and correlational studies with insignificant effect sizes. The studies are full of inconsistencies and contradicting results since the impact of electronic devices is dependent on the type of device usage, cognitive measures and the population. Vedechkina and Borgonovi (2021) highlighted that certain programming features like content cuts and shorter scene lengths may be detrimental to cognitive control development and overstimulate brains that are still developing. Programs without advertisement breaks are associated with positive inhibitory control, while poor control is measured when similar content with advertisements is viewed. Breaks in programming for commercials engage and re-engage attention to the screen and increase the difficulty for children to extract meaning from programming and link concepts. Vedechkina and Borgonovi (2021) found that several cross-sectional studies have associated TV watching amid infancy with negative cognitive aftermath later in life. Vedechkina and Borgonovi (2021) stated that the existing literature on video gaming mostly focused on adolescents and adults. Vedechkina and Borgonovi (2021) were adamant that multitasking with electronic devices caused disruptions to sustained attention and impacted self-regulation, memory, learning and motivation detrimentally. Continuous multitasking with electronic devices causes deficits in cognitive functioning related to long-term and working memory, inhibitory control and impulse responses. Multitasking with devices while learning is associated with negative impacts on academic outcomes, perceived learning and academic attitudes. The amount of time dedicated to learning and academic activities is displaced, which also limits the available attention for simultaneously processing the academic content. TV's that play in the background also weakens the quality and quantity of synchronous activities, such as sustained play and homework. Vedechkina and Borgonovi (2021) found several limitations of existing literature, such as the limited populations, convenience samples, cross-sectional designs and self-report instruments.

Wilkinson, Low and Gluckman (2021) compiled a report on the influence of recreational screen time (social media, games and TV) on learners' cognitive, social and emotional development. Primary school learners in New Zealand aged five to twelve were observed and extensive associations were found between behaviour problems (hyperactivity and inattention) and executive functioning, which depended heavily on the content and type of screen time (Wilkinson *et al.*, 2021). Negative correlations were discovered between video and TV watching and achievement in mathematics and executive functioning. Watching programmes and gaming for several hours daily is directly linked to hyperactivity and inattention in children aged seven. Wilkinson *et al.* (2021) also noted that screen time in general before bed harms academic achievement. The study was limited by the observational research approach, which challenges the researchers in separating the effects of screen time from various other factors that impact development. Most of the evidence was based on TV viewing, which did not accommodate newer interactive electronic devices (Wilkinson *et al.*, 2021).

Gottschalk (2019) referenced a study on TV viewing and children, which found that 10 per cent of the children who participated in a survey watched upwards of seven hours of TV daily and noted that moderate viewing may not harm cognitive development. Educational TV programmes have been associated with improved mathematics, problem-solving, literacy and science skills. Gottschalk (2019) critiqued the available literature on the limitations, for using parental self-reported surveys (social desirability and recall bias), small samples and cross-sectional designs.

2.5 Chapter summary

The literature review chapter introduced the conceptual and theoretical frameworks, followed by a review of related empirical studies. The conceptual framework firstly covered the impact of the COVID-19 pandemic in South Africa and worldwide. Second, the different electronic devices (smartphones, computers, tablets, television sets and video game consoles) were discussed alongside some of their known effects on learners. The social and cognitive development of learners were explained and the necessity of socio-cognitive development was highlighted. Albert Bandura's Social Cognitive Theory was discussed as this study's framework. A review of related empirical studies followed the theoretical framework. Amid the COVID 19 pandemic

electronic device usage by learners during the increased in all reviewed studies. The impact of the usage of electronic devices on the social and cognitive development of learners was reviewed and most of the studies reported detrimental effects on development. The literature review chapter concluded with a summary of the contents. Chapter 3 will focus on the research design and methodology for the study.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The previous chapter delved into the relevant literature pertaining to the study at hand. Chapter 3 focuses on the research methodology for the study. The post-positivism research paradigm is discussed, followed by the quantitative research approach. The ex-post facto and survey design of the study is explained, followed by the study site, population, sample size and sampling procedures. The instruments for data collection are discussed, followed by the measures of instruments' validity and reliability and piloting. This is followed by the data collection and analysis procedures. The chapter concludes with the ethical considerations for the study and the chapter summary.

3.2 Research paradigm

Education research follows a systematic inquiry approach to specific issues or topics (Khatri, 2020:1435). Scientific procedures are followed to study these problems and phenomena in the social context of the problem. A research paradigm is a philosophical or theoretical background for a study, which depicts the worldview of the researcher. This perspective of the researcher functions as a lens through which a problem is examined and determines the methodological aspects that are implemented in a study (Khatri, 2020). The research paradigm is post-positivism for this study. Post-positivism was established as a worldview in reaction to the limitations of positivism (Panhwar, Ansari & Shah, 2017). Post-positivism balances interpretivism and positivism and is, therefore, an amended form of positivism. This paradigm attends to many of the established critiques of quantitative designs while prioritizing quantitative methodology (Kankam, 2019). Post-positivism aims at exploring phenomena scientifically and accentuates properly understanding the perspectives of a study using multi-methods and multi-dimensions. This perspective broadens the narrow perspective of positivism to create a more inclusive way to investigate problems in the real world (Kankam, 2019).

Many researchers in education restrict studies to qualitative perspectives while disregarding the quantitative and objective side (Panwar *et al.,* 2017). Educational research achieves more success when both quantitative and qualitative aspects are included, by enhancing validity and reliability. Post-positivism prioritises quantitative

data and accentuates the ability of qualitative data to strengthen findings (Panwar *et al.,* 2017). Educational research is pluralistic, and all relevant aspects of educational phenomena should be investigated. Post-positivism is a flexible perspective, which reduces prejudices and personal biases of the researcher by investigating the phenomena from various angles, using different instruments (Panwar *et al.,* 2017). Post-positivism as a perspective allows the researcher to investigate individuals' behaviours. This perspective values naturalistic and non-experimental research practice, in which the researcher does not control the subjects or the research environment. Post-positivism encourages the collection of data in a short period, which promotes the accurate analysis of the statistical data (Kankam, 2019).

In this study, parents, teachers and learners all give input to help determine the impact of COVID-19 and the perceived increase in electronic device usage on the socio-cognitive development of learners. The post-positivist approach allows for the study of actions, behaviours, and consequences of individuals or groups through observation, interpretation and statistical analysis. This perspective views people as sentient subjects who should be studied within their context and recognises that no scientific method is a hundred per cent accurate, since all methods have their shortcomings and limitations (Panwar *et al.,* 2017). Post-positivism is therefore a fitting approach to this study which enables accurate interpretation and in-depth analysis of research done empirically (Kankam, 2019).

3.3 Research approach: Quantitative

Educational research is becoming progressively reliant on data to chronicle phenomena, explain changes, gather empirical evidence, and create theories for analytical reasoning when suggestions are proposed to alter educational policy (Yue & Xu, 2019). The research approach for this study is quantitative. Hakizimana (2016) stated that a quantitative approach is associated with the positivist and post-positivist research paradigm in general. Quantitative research focuses on collecting data and converting it to a numerical format, which then enables the researcher to perform statistical calculations and draw appropriate conclusions. The hypothesis of the study contains a prediction of the anticipated relationship among the variables (Hakizimana, 2016). The hypothesis of this study states the predicted relationship between the COVID-19 pandemic and the perceived increase in electronic device usage and their

impact on the socio-cognitive development of learners. The quantitative research approach emphasises the use of a variety of instruments and materials (computer tests, surveys, and questionnaires) and a definite plan of action (Hameed, 2020). The data collected by these various means have to follow a strict procedure and are converted to a numerical format for statistical analysis, which enables the researcher to calculate the degree to which the variables are correlated. This relationship could be causal or a simple association (Hakizimana, 2016).

Objectivity is crucial in quantitative research - the researcher should avoid results being affected by personal attitudes and behaviours and examine methods and conclusions drawn for possible bias. The data collected in quantitative research can be categorised, formed into units of measurement, or be ranked (Ahmad, Wasim, Irfan, Gogoi, Srivastava & Farheen, 2019). Quantitative research methods should measure what they claim to measure, and external factors should be controlled to avoid any impact on the results. This is not always a possibility, but should still be considered (Hakizimana, 2016). The emphasis in quantitative research is on deductive reasoning and a top-down approach, which moves from general to specific. The conclusions drawn from collected data are reliant on prior statements, conditions and findings, which increase validity (Hameed, 2020). Inductive reasoning elements may be included in the study. Samples in quantitative research are representative of the wider population and random sampling is preferred (Hakizimana, 2016). The researcher aims to generalise findings beyond the context of the study, which is why the sample should be representative. Quantitative research also specifies the procedures followed in a study, to enable the replication of the study elsewhere (Hakizimana, 2016).

3.4 Design of the study

This study followed an ex-post facto and survey design. Ex-post facto studies are undertaken when the researcher identifies a current event or an event that already occurred. The event in the current study was the outbreak of the COVID-19 pandemic and its disruption of schooling since 2020. The researcher collects data to demonstrate the possible correlation between the contextual factors and the subsequent changes in behaviours or characteristics of participants (Rahman, 2021). The researcher mainly reports on what is happening or what has happened, and no direct manipulation of the independent variable takes place (Ismail, 2021). The treatment or experience took

place before the study began (Rahman, 2021). Ex-post facto studies are dependent on systematic empirical investigation, even though the researcher does not have direct control over the independent variables and this research is mostly descriptive. The researcher describes the contextual conditions of the situation and aims to determine the causes and reasons for the phenomena under investigation (Kabir, 2016). An ex-post facto study is designed to compare two or more samples, which can be compared based on a specific occurrence. The focus is on what happens differently for the groups compared and intends also to determine if the individuals have different experiences (McMillan & Schumacher, 2014). The researcher wants to determine in this study whether COVID-19 increased electronic device usage and if this had an impact on the socio-cognitive development of learners. The learners were grouped according to their screen time: minimal usage (one to two hours daily), average usage (three to five hours daily), and high usage (6+ hours daily). The researcher was hereby able to compare the different groups and ascertain how they were impacted differently by the COVID-19 pandemic and the perceived increase in electronic device usage.

This study also implemented a survey design, which is one of the most widely used quantitative research designs in social research (Leavy, 2017). This design enables researchers to gather data from large samples and thereafter, make generalisations regarding the larger population. Survey designs are implemented to explore the beliefs, attitudes, and opinions of individuals, while also reporting on their behaviours and experiences. This design is cross-sectional, where data is collected at a specific time (Leavy, 2017). Data was collected from parents, teachers and learners in early 2022, while the COVID-19 pandemic was still ongoing.

3.5 Study site

The study site for this research is a preparatory school in Cradock. Cradock is a rural town in the Eastern Cape. Cradock and its two townships, Michausdal and Lingelihle, are located next to the Great Fish River. Cradock has been surrounded by farms for two centuries and produces agricultural products (Meyers-Mashamba, 2021). Cradock forms part of the Chris Hani District and has twenty schools, ranging from pre-primary to high schools. This culturally and ethnically diverse town is populated by Caucasian, Black, Coloured, Indian and Chinese people (Municipalities, 2016). The school where the study was conducted is a reflection of the population of Cradock, Michausdal and

Lingelihle. The school has four classes per grade - from Grades 1 to 3, of which two are English Home Language classes and the other two are conducted in the Afrikaans Home Language. It is a public school and is technologically advanced. Teachers at the school have access to laptops, projectors, visualisers, and interactive whiteboards in all of the classrooms. The school prioritises the safety of learners, which is ensured by remote-controlled gates and security cameras in all classrooms and around the terrain.

3.6 Population, sample size and sampling procedures

The key population comprised of learners who were in Grade 1 in 2020 and were in Grade 2 when the study began. These learners progressed to Grade 3 in 2022 and remain crucial to the study. The full population of is therefore the parents of the Grade 3 learners, the Grade 3 learners and their teachers at a preparatory school in Cradock. The learners were in Grade 1 when the COVID-19 pandemic was at its worst in South Africa in 2020 and the National Lockdown occurred. These learners missed out on approximately five months of classroom teaching. They had to complete curricular activities on Google Classroom and on worksheets, where parents were their primary teachers while the learners were staying at home. Grade 1 is a crucial foundation for all further learning, and it was severely disrupted by the national lockdown Wiederhold (2020). The parents of these learners also participated in the study, to give insight into the electronic device usage of the learners at home. The Grade 3 teachers participated in the Social Development Questionnaire about the learners. They worked closely with the learners and observed their social interactions. The teachers could answer the questions honestly, without worrying about the social desirability of answers, whereas parents answered questions about their children's social development in a manner that they deemed socially desirable.

The first sample for the study was the parents of the Grade 3 group of 2022, which included 108 learners in total. One parent per child was invited to complete the first questionnaire on the time spent by learners on electronic devices. After the completion of the first instrument, the learners were grouped by their levels of electronic device usage, namely minimal usage (one to two hours daily), average usage (three to five hours daily), and high usage (6+ hours daily). Ten learners were sampled from each category to participate in the remaining two questionnaires. The teachers complete a

questionnaire based on their observations of the social development of learners and the learners completed a mathematics achievement test for cognitive development. The sample size for the remaining instruments, therefore, totalled thirty, and the four Grade 3 teachers completed the Social Development Questionnaire regarding the learners individually.

The sampling method was purposive random sampling, which is a variation of stratified purposive sampling. This method requires a randomised selection of a small number of participants from the larger population. This method of sampling seeks out the best cases for the research project to produce the most relevant and best data to answer the research questions. This strategy is used when qualitative results can strengthen the quantitative findings (Leavy, 2017; McMillan & Schumacher, 2014). The third questionnaire that the teachers completed contained a qualitative component, which comprises semi-closed ended questions on which the teachers may elaborate.

Leavy (2017) asserted that purposive sampling leads to richer data since the participants are strongly related to the topic. This method also makes the transfer of findings between cases possible, based on their similarities, which then enables the researcher to make inferences about a case based on the findings of a different case (Leavy, 2017). The main sample of 108 Grade 3 learners, their teachers and their parents were purposefully selected since they produced the greatest impact in the Foundation Phase. The ten learners per category were randomly selected after all participants (with linked numbers) were sorted by their levels of electronic device usage. The Google Random Number Generator was used to sample the total of thirty learners from the groups.

3.7 Instruments for data collection

Data was collected by means of three questionnaires. Hakizimana (2016) stated that questionnaires are a useful way of collecting data from a great number of people, which includes people who are too busy to participate in interviews and experiments. Questionnaires offer participants the ability to take their time, think about answers and continue the questionnaire at a convenient time. Questionnaires allow participants to state their views privately, which may contribute to more honest answers and lessen their desire to give socially acceptable answers (Hakizimana, 2016). Questionnaires

usually include multiple-choice questions, attitude scales or open- and closed ended questions. Researchers may also administer questionnaires in person. Google Forms were used to create the questionnaires. Google Forms are used widely to create surveys with ease and allow for different question types, such as grids, linear scales, multiple selections, short answers, and paragraphs (Melo, 2018). It is a free online tool, with which surveys can be created by anyone with a Google account. Each form has a unique link that can be sent to participants via social media, email and WhatsApp. All feedback from participants is stored and Google Forms are integrated with Google Sheets (spreadsheets), which enables the researcher to convert data to a spreadsheet for analysis. Google Forms allows users to collect the email addresses of participants and limit the number of times participants may submit their answers (Melo, 2018). The first questionnaire was the **Screen time Questionnaire**. The link to the questionnaire was forwarded on the WhatsApp groups of the Grade 3 classes by the teachers. The parents who agreed to participate in the survey received receive the printed consent forms, as well as the assent forms for their children. The parents had a week to complete the questionnaire via the link provided. The questions included the following:

Personal information:

Child's name and surname:
Child's age:
Child's gender:
Child's ethnicity:
Please indicate which of the following devices your child has access to (check all that apply):
Does your child suffer from any chronic medical condition? (Please select all that apply)

Screen time:

1. *How many hours daily did the learner use these electronic devices for entertainment before the pandemic?*
2. *How many hours daily did the learner use these electronic devices for entertainment during the pandemic?*

3. *How many hours daily did the learner use electronic devices for educational activities before the pandemic (educational games or Google Classroom)?*
4. *How many hours daily did the learner use electronic devices for educational activities during the pandemic (educational games or Google Classroom)?*
5. *How many hours daily did the learner play together with friends or siblings on electronic devices before the pandemic?*
6. *How many hours daily did the learner play together with friends or siblings on electronic devices during the pandemic?*
7. *How many hours did you spend on electronic devices together with the learner before the pandemic?*
8. *How many hours did you spend on electronic devices together with the learner during the pandemic?*

The data collected from the **Screen time Questionnaire** was analysed and learners were grouped according to their levels of electronic device usage, namely minimal usage (one to two hours daily), average usage (three to five hours daily), and high usage (6+ hours daily). Ten learners per group were then randomly selected, totalling thirty participants. The second and third questionnaires were conducted at about the same time. The **Social Development Questionnaire** was sent via WhatsApp to the four Grade 3 teachers. The teachers answered the questions with regard to the thirty learners participating in the study who are in their classes. The teachers had two weeks to complete the questionnaire. The questionnaire contained the following questions and worked with a rating scale:

Rating scale:

1. Poor
2. Fair
3. Good
4. Very Good
5. Excellent

Participant number:

1. *The learner cooperates in group settings.*
2. *The learner spends a lot of time talking with peers.*

3. *The learner builds lasting friendships.*
4. *The learner demonstrates growing independence from parents.*
5. *The learner demonstrates problem-solving, negotiating and compromising skills with peers.*
6. *The learner is aware of their own scholastic performance.*
7. *The learner demonstrates empathy and compassion.*
8. *The learner participates in elaborate fantasy play and interactive games.*
9. *The learner can identify and describe emotions and reflect on the motives of others.*
10. *The learner demonstrates sportsmanship - and can cope better with losing.*
11. *The learner enjoys playing with same-gender peers.*
12. *The learner participates in group games where they create their own rules.*
13. *The learner shows concern for fairness and justice.*
14. *The learner demonstrates sharing with peers.*

The third instrument was completed by the learners, which was an achievement test in questionnaire form. The achievement test included questions on each focus area of Mathematics in Grade 3, namely Numbers, Operations and Relationships; Patterns, Functions and Algebra; Space and Shape; Measurement; and Data Handling. The **Cognitive Development Questionnaire** was printed out for the learners to complete, after which the researcher recorded their answers on the Google Form. The achievement test contained the following questions:

Participant number:

1. *Make groups of five and count the balls.*
2. *154 + 179 =* □
3. *26 x 5 =* □
4. *69 ÷ 3 =* □
5. *Sort the numbers from smallest to largest:*
6. *Tim has 145 pens. He gives 118 pens to Tom. How many pens does Tim have left?*
7. *Halve 192:*
8. *Count how much money is in the picture:*
9. *Complete the number pattern:*

140, 144, 148, _____, _____, _____, _____, 168

10. *Name the shape:*
11. *Can the shape roll or glide?*
12. *Draw the line of symmetry:*
13. *What time is it?*
14. *Which two instruments do we use to measure mass? Circle them:*
15. *Which two children read between 5 and 10 books?*

The learners completed the achievement test in groups of ten at school in the afternoon. They had an hour to complete the test.

3.8 Measures of instruments' validity and reliability and piloting

The validity of a research instrument is represented by measuring what it is intended to measure (Setia, 2017). Validity is the extent to which information obtained from questions is systematically different in relation to the concept's meaning, questions related to the same concept, and hypotheses or theories about the anticipated connection to the concepts (Setia, 2017). The instruments in this study were subjected to face validation. Face validation is regarded as a personal judgement of the instruments, which is done by an expert in the subject area. The instruments are assessed by the researcher after their design and are evaluated for their appropriateness and relevance on the 'face of it' (Setia, 2017). Experts evaluate the questionnaires for unambiguity, relevancy, clarity and reasonability. The instruments should therefore be uncomplicated and instructions easy enough to be followed while being at an appropriate level of difficulty (achievement test) (Desai & Patel, 2020). These instruments were judged by two experts in ECE and Care. These experts used the categorical options of "Yes" and "No" to indicate the favourability of questions, after which their responses were be analysed using Cohen's Kappa Index (CKI) to calculate the validity of the instruments. A minimum rating for Kappa is 0.60 for inter-rater agreement (Taherdoost, 2016). Based on the evaluations of the experts, the researcher modifies the instruments.

Face validation was done by two experts on the three instruments with a total of thirty-one questions. The CKI for the instruments was calculated as 0.89, which is an acceptable inter-rater agreement. The researcher adjusted the questions pointed out

by the experts according to their suggestions, which mainly prompted increasing the difficulty level of the mathematics achievement test and including sums that require a specific method to solve.

The reliability of the instruments was determined after they had been validated. The reliability of the instruments is the degree to which the measurement of an occurrence provides dependable results (Taherdoost, 2016). The modified instruments were subjected to pilot testing with three learners, three parents and three Grade 3 teachers. The data collected from these participants will not be used in the main data collection and analysis. The data from the two survey questionnaires (Screen time Questionnaire and Social Development Questionnaire) will be subjected to the Cronbach Alpha reliability estimates, which determine the internal consistency indices of the questionnaires. A pilot study should have a reliability of 0.60 or higher (Taherdoost, 2016). The data from the Screen time Questionnaire was measured at a reliability of 0.77, while the Social Development Questionnaire measured 0.65 on the reliability index. Both of these instruments were therefore considered reliable.

On the other hand, the data obtained from the mathematics achievement test was subjected to the Kuder-Richardson formula twenty reliability test. This determines the internal reliability of a test with only two answers: right and wrong. The instrument should have a reliability score of 0.7 or higher (Taherdoost, 2016). The data collected from the mathematics achievement pilot test was calculated at a reliability score of 0.76, which therefore confirms the reliability of the cognitive development instrument.

3.9 Data collection procedures

Data collection followed a set procedure of two phases. The first phase started with a letter that has been sent to the principal of the school and the Eastern Cape Department of Education to ask permission to conduct the study with the parents, learners and teachers of the school. Permission was granted by both parties to conduct the study. Second, the researcher determined the validity and reliability of the instruments by conducting the pilot test with three parents, three learners and three Grade 3 teachers. The Screen time Questionnaire and the Social Development Questionnaire were sent to the parents and teachers respectively on WhatsApp. The teacher participants had one week to complete the questionnaires for the pilot test,

while the ten learners completed the achievement test during the same week. The researcher determined the validity and reliability of the instruments as discussed in the previous section and modified the instruments accordingly.

The second phase of the data collection process started with the researcher sending the link for the Screen time Questionnaire to the Grade 3 teachers and asking them to share it with their class groups on WhatsApp. Parents who indicated that they and the learners wanted to participate in the study, received the consent and assent forms to complete and send back. The parents then had a week to complete the questionnaire. After the parents completed the questionnaire, the researcher sorted the learners into the levels of electronic device usage, namely minimal usage (one to two hours daily), average usage (three to five hours daily), and high usage (6+ hours daily). Ten learners per category were randomly selected by the Google Random Number Generator, which totalled thirty participants.

The Social Development Questionnaire was sent to the Grade 3 teachers along with their consent forms, in which they agreed to confidentiality regarding the names and information about the learner participants. The teachers only completed the questionnaire about those learners enrolled in their classes. The teachers had two weeks to complete the questions for each of the thirty learners. During that two-week period, the researcher conducted the mathematics achievement test (Cognitive Development Questionnaire) with the learners. The researcher scheduled three sessions during which the achievement test was completed by the learners in groups of ten, after school. Each group had one hour to complete the test on the printout Google Forms. The researcher remained in the classroom to ensure that the participants completed the test without any disturbances and offered guidance to the participants if necessary. Afterwards, the researcher recorded the answers selected by the participants on the Google Form.

3.10 Data analysis procedures

Quantitative research provides potentially important information and can be analysed descriptively or inferentially (Kaur, Stoltzfus & Yellapu, 2018). Descriptive statistics may comprise of measures of central tendency, measures of frequency, and variation, whereas inferential analysis, can help to draw associative, causative or other

conclusions from the data collected (Kaur *et al.*, 2018). The quantitative data was compiled using online Google Form Questionnaires, of which the responses was converted to Google Sheets. Descriptive statistics was used to define and outline data in order to answer the research questions, while inferential statistics was used to test the hypotheses. The data was specifically, analysed using frequency, percentage and mean to answer the research questions while the hypotheses was tested at a 0.05 level of significance using analysis of variance (ANOVA). In terms of descriptive analysis, the measure of the frequency of the data was expressed as a percentage, which is a way of describing a proportion as a fraction of 100 (Kaur *et al.*, 2018).

Measures of central tendency describe the complete set of data as one measurement, which include the mean, mode, and median. The mean is the sum of the data set values divided by the total number of observations, or the arithmetic average of the data set (Kaur *et al.*, 2018). The median is the value in the middle of the distribution of data ranked in order from ascending to descending (or vice versa). The mode is the value that is most common in the data set (Kaur *et al.*, 2018). The measures of variation describe the degree to which the values of a variable are identical or diverse, which includes the range, variance and standard deviation of the data. The variation and standard deviation measure the spread of closeness of each observed value to the mean of the data set (Kaur *et al.*, 2018).

The inferential data analysis was done by the ANOVA, which is widely used when comparing multiple groups in research (Chen, Xu, Tu, Wang & Niu, 2018). The ANOVA model extends the normal t-test that compares two groups, to allow for more than two groups to be compared on one independent variable. ANOVA enables testing the disparities among all groups and draw more accurate probability conclusions, which is more difficult if a series of separate t-tests are used (Chen *et al.*, 2018). The statistical formula of ANOVA uses the variances of the groups to calculate a value reflecting the severity of disparities between the means. ANOVA calculates an *F* statistic (*F*-ratio), which enables the researcher to find the level of significance and reject or confirm the null hypothesis (Chen *et al.*, 2018).

The data from the Screen time Questionnaire was analysed first, to allow the researcher to group the learners according to their levels of electronic device usage. This was achieved by calculating the average daily time spent on electronic devices

by each participant in Google Sheets. The data collected on the manner in which learners spend their time on electronic devices and other activities was analysed by measuring central tendency and variation.

The data from the Social Development Questionnaire and the Cognitive Development Questionnaire (achievement test) was then analysed descriptively and inferentially, to determine if there is a correlation between the time spent on electronic devices amid the COVID-19 pandemic and the socio-cognitive development of learners. Once the analysis was concluded, the results of the descriptive and inferential analysis were represented visually. Measures of frequency and variation were presented in tables, histograms or bar graphs for easy interpretation (Kaur *et al.*, 2018). The inferential statistics were presented in tables and a box plot to showcase the variations between the three groups (Chen *et al.*, 2018).

3.11 Ethical considerations

Ethical considerations are crucial to social research (Leavy, 2017). These considerations come into play immediately when a topic is selected for the study. The selection of a topic depends on the values of the researcher, the understanding of current problems requiring research, and the impact that the research will potentially have (Leavy, 2017). All the aspects regarding the people involved in the study are ethical decisions, which include participant selection, interactions with participants, relationships in the research, and the dissemination of research findings to interested parties and those who benefit from the research (Leavy, 2017). The researcher, therefore, has a responsibility to plan the study with ethical considerations in mind, which include gaining entry, the participant's right, informed consent, confidentiality, protection from harm, achieving anonymity, maintaining professionalism, and the participants' vulnerability.

3.11.1 Gaining entry

Gatekeepers for the research project were contacted per email and asked for permission and consent to perform the study (Leavy, 2017). The gatekeepers for this project are the ECDOE, the school governing body, the principal, teachers, and parents of the learners. The gatekeepers were informed of the aims of the study and all relevant information. The study was conducted with respect to all gatekeepers.

Permission was granted for the researcher and learner participants to remain on the school grounds after school on pre-arranged dates for the duration of the achievement test.

3.11.2 Participants' right

Participants have a right to ask questions and participation is voluntary (Leavy, 2017). Participants may ask the researcher for clarification on completing the achievement test. Parents give their approval for their children to participate in the study. If the learner is unwilling to complete the achievement test for the study, he or she can refuse participation. Consent was checked up continuously - a learner, teacher or parent may change his or her mind. An opt-out letter was sent to parents, which they only complete and send back if they did not want their child to participate. This also gave the learner the opportunity to decide if he or she wants to participate. A participant can withdraw from the study without penalties.

3.11.3 Informed consent

Consent was informed. The study aims and methods were described to the principal, school governing body, teachers, parents, and learners in written form. Parents and teachers completed a consent form with all of the relevant information regarding the study and their roles in it, which included the title of the research, research methods and procedures, the intended outcomes of the research, possible risks and benefits of participation, the voluntary nature of participation, steps to ensure confidentiality, compensation for participation, and contact information for the principal investigator (Leavy, 2017). Parents also filled in a consent form regarding the participation of their children. The research was also be explained to the learners in a manner that they understood, through a PowerPoint Presentation. The researcher explained the benefits of the intended research to the target population and made it clear that they were in no manner being exploited (Leavy, 2017).

3.11.4 Obtaining assent

Parents were informed about all aspects of the study and asked to give approval for their children to participate in the study. However, Leavy (2017), points out that if parents or legal guardians give their consent, learners may be asked to assent to the study. Therefore, learners agree to participate after being informed about the study

and any potential for risk or harm. Assent is obtained when minors are old enough to comprehend that they are volunteering to participate and may refuse without penalty. Children are generally considered old enough at nine years of age (Leavy, 2017). Parents and learners completed the informed assent form if they choose to participate in the study. The assent form contained the crucial information regarding the study in simple terms, to enable the participants to understand what they assent to participate in.

3.11.5 Confidentiality

All responses given via the questionnaires were confidential. No visual data was collected. The data collected and the participants of this study were not discussed with anyone not involved in the study. The names of the learners were only known by the researcher and the teachers participating in the study, who signed a confidentiality statement. Numbers were assigned to learners to ensure that they cannot be linked to participants after the study (Leavy, 2017). All data containing information about the participants was stored on a computer protected by a password and also on Google Drive. The data will be erased after five years.

3.11.6 Protection from harm

Participants were not caused distress. If a parent did not want a child to participate, he or she were not forced to do so. No physical or mental harm were done to participants. The questionnaires were carried out without embarrassing, offending, frightening, or harming participants (Leavy, 2017). This was made possible by teachers and parents completing questionnaires from the privacy of their homes. Learners completed the achievement test in a classroom setting, which is familiar to them and a safe environment. The school gate was locked as per school regulations to ensure the safety of learners. All COVID-19 protocols were followed when learners participated in the mathematics achievement test in the school classroom. Participants were not harmed by the reporting of the collected data - no references to individuals were made.

3.11.7 Achieving anonymity

Anonymity was firstly achieved by keeping the name of the school anonymous. Results and participants remained anonymous - each participant was given a number.

All data corresponding to the participant was linked to their given number. If any participant wished for their name to be used, a pseudonym was given with the help of the child or parent (Leavy, 2017). It was not possible to identify any participant in the reporting and analysis of the collected data. All hard and soft copies of the data is stored safely for a maximum of five years, after which it will be destroyed.

3.11.8 Maintaining professionalism

Data, results, methods, and procedures were reported honestly. No data was fabricated, misrepresented, or falsified. Gatekeepers (parents, principal, school governing body, teachers, and learners) were not deceived with regard to the aims and procedures of the intended study (Leavy, 2017). The researcher conducted the study in a manner that reflected respect for the participants, benefited the wider community, and protected vulnerable populations (children). The researcher gave credit to the contributions of other researchers and avoided plagiarism.

3.11.9 Participants' vulnerability

The participants in this study were parents, teachers and learners. The participants were handled with respect and not placed in a situation where they felt vulnerable. They could decide if they wanted to participate and to what extent they wanted to respond to questions on the questionnaire (Leavy, 2017). The questionnaires were designed in a manner that determined the social and cognitive development of the learners without embarrassing the participants or pointing fingers at anyone. The intent of the study was to enlighten parents, teachers and the ECDOE about the impact of the perceived increase in screen time on the social and cognitive development of learners. This may encourage these parties to address the possible developmental delays to ensure the holistic development of learners.

3.12 Chapter summary

This chapter explained the use of post-positivism as a research paradigm, along with the quantitative approach to the research. The ex-post facto and survey design of the research was elaborated on. This chapter also addressed the study site, population, sample size and sampling procedures for the study. This was followed by the discussion of the three instruments for data collection and how the instruments will be

validated and tested for reliability with pilot testing. The data collection and analysis procedures were stated, followed by the ethical considerations for the study.

The next chapter will present the research findings and analysis on the impact of electronic devices during the COVID-19 pandemic on the socio-cognitive development of Grade 3 (Grade 2 of 2021) learners.

CHAPTER 4: RESEARCH RESULTS

4.1 Introduction

Chapter 3 discussed the research design and methodology for the study at hand in detail. This chapter will present and explain the research findings from the five research questions, to provide an answer to the research main question and hypothesis. The results will be presented according to the themes that emerged during the research processes. The data was generated from learners, their parents and their teachers, which generated mainly numerical data and qualitative data from semi-closed ended questions in the Social Development Questionnaire. Firstly, the respondents in this study will be discussed. The time spent by Grade 2 (which are now in Grade 3 in 2022) learners on electronic devices before the COVID-19 pandemic will be presented next, alongside the time spent by these learners on electronic devices during the pandemic. The next section will focus on the levels of usage of electronic devices by the learners. Finally, the impact of the different levels of electronic device usage on the socio-cognitive development of the learners will be discussed. The chapter will conclude with a summary of the themes that were discussed.

4.1.1 Themes that emerged from the study

Table 4.1: Themes that emerged from the study

Source: Summary of Research Questions and Themes

The impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development	
1. The amount of time spent by Grade 2 learners on electronic devices before and during the COVID-19 pandemic	1.1. Television 1.2. MP3 Player 1.3. Cell Phone 1.4. Tablet 1.5. Video Game Console 1.6. Computer 1.7. Educational Games / Google Classroom 1.8. Parent and child engaged with electronic devices 1.9. Total daily screen time
2. The levels of electronic device usage by learners during the COVID-19 pandemic	2.1. Minimal usage 2.2. Average usage 2.3. High usage
3. The impact of different levels of electronic device usage on the social development of learners	3.1. Social interaction with peers 3.2. Social interaction with parents 3.3. Social play 3.4. Individual social skills
4. The impact of different levels of electronic device usage on the cognitive development of learners	4.1. Mathematical errors 4.2. Numbers, operations and relationships

	4.3. Patterns, functions and algebra 4.4. Space and shape 4.5. Measurement 4.6. Data handling 4.7. Total impact on cognitive development

4.2 Respondents

The Screen time Questionnaire was forwarded to the parents of the 108 Grade 3 (Grade 2 in 2021) learners via the class WhatsApp groups of the four Grade 3 teachers. The questionnaire remained open for responses for a week, after which the questionnaire was closed on Google Forms. The Google Form initially collected fifty-nine responses, of which two were duplicates and were removed from the exported Google Sheet. Therefore, fifty-seven responses were collected and used in the data analysis and selection of the thirty participants for the remaining two questionnaires, which is 52.7 per cent of the total population of the Grade 3 group. The population of the respondents were as follows: White (26), Black (23), Asian (1), and Coloured (7). Twenty-four respondents were male and thirty-three were female. These learners form part of the Cradock population, the surrounding farms and the two townships, Lingelihle and Michausdal. The cognitive development achievement test was carried out in the last week of term 2 of 2022, and the Social Development Questionnaire link was sent to the Grade 3 teachers a week prior. This allowed the researcher to compile all remaining data in two weeks.

4.3 The amount of time spent by Grade 2 (Grade 3 in 2022) learners on electronic devices before and during the COVID-19 pandemic

4.3.1 Television

Responses by participants indicate that forty-eight learners had access to a television. The total number of hours spent on viewing television by the learners before the pandemic amounted to 91 hours daily, which increased to 125 hours during the pandemic. Television viewing, therefore, increased by 37.3 per cent during the pandemic. Before the pandemic, learners watched up to 5 hours of television, with an average of 1.89 hours daily. The mode and median for television viewing were two hours daily before the pandemic. During the pandemic, television viewing by learners reached more than six hours daily, with an average of 2.5 hours. The mode and median were also two hours daily during the pandemic. The variance of the data

relating to before and during the pandemic, was 1.27 and 2.03 respectively - which points to a greater degree of dispersion between responses amid the pandemic. The standard deviation before and during the pandemic, was 1.12 and 1.42 respectively - which indicates that there is a slightly larger dispersion of the responses around the mean during the pandemic.

4.3.2 MP3 player

Only two learners make use of an MP3 player. Before the pandemic, these learners spent a total of 2.5 hours daily listening to music on an MP3 player. During the pandemic, these learners spent a total of 4 hours daily on an MP3 player. Since there were only two learners who make use of an MP3 player, the impact of this device is insignificant.

4.3.3 Cell phones

According to the responses, forty-two learners have access to cell phones. The total number of hours spent on cell phones by the learners before the pandemic amounted to fifty-nine hours daily, which increased to 83.5 hours during the pandemic. Cell phone usage, therefore, increased by 41.5 per cent during the pandemic. Before the pandemic, learners spent up to five hours on cell phones, with an average of 1.39 hours daily. The mode for cell phone usage was 0.5 hours daily before the pandemic, while the mean was one hour. During the pandemic, cell phone usage by learners reached more than six hours daily, with an average of 1.5 hours. The mode and median were one hour daily during the pandemic. The variance of the data relating to before and during the pandemic, was 1.24 and 2.09 respectively - which shows a greater degree of dispersion between responses amid the pandemic. The standard deviation before and during the pandemic, was 1.11 and 1.44 respectively - which indicates that there is a slightly larger dispersion of the responses around the mean during the pandemic.

4.3.4 Tablet

Responses show that only fourteen learners have access to tablet devices (iPad, Samsung Tablet, etc.). The total number of hours spent on tablets by the learners before the pandemic amounted to 19.5 hours daily, which increased to 32 hours during the pandemic. Tablet usage, therefore, increased by 64.1 per cent during the

pandemic. Before the pandemic, learners spent up to four hours on tablets, with an average of 1.39 hours daily. The mode for tablet usage was 0.5 hours daily before the pandemic, while the median was 0.75. During the pandemic, tablet usage by learners reached more than six hours daily, with an average of 2.28 hours. The mode was one hour daily during the pandemic, while the median was 1.5 hours daily. The variance of the data relating to before and during the pandemic, was 1.61 and 2.88 respectively - which shows a larger degree of dispersion between responses during the pandemic. The standard deviation before and during the pandemic, was 1.27 and 1.69 respectively - which shows a slightly larger dispersion of the responses around the mean during the pandemic.

4.3.5 Video game console

According to the responses, only nine learners had access to video game consoles. The total number of hours spent on video game consoles by the learners before the pandemic amounted to eight hours daily, which increased to fifteen hours during the pandemic. Video game console usage, therefore, increased by 87.5 per cent during the pandemic. Before the pandemic, learners spent up to two hours on video game consoles, with an average of 0.88 hours daily. The mode and median for video game console usage was one hour daily before the pandemic. During the pandemic, video game console usage by learners reached up to four hours daily, with an average of 1.66 hours. The mode and median were one hour daily during the pandemic. The variance of the data relating to before and during the pandemic, was 0.20 and 1.72 respectively - which points to a large degree of dispersion between responses during the pandemic. The standard deviation before and during the pandemic, was 0.45 and 1.31 respectively - which indicates a larger dispersion of the responses around the mean during the pandemic.

4.3.6 Computer

A total of seventeen learners had access to computers. The total number of hours spent on computers by the learners before the pandemic amounted to seventeen hours daily, which increased to 26.5 hours during the pandemic. Computer usage, therefore, increased by 55.8 per cent during the pandemic. Before the pandemic, learners spent up to two hours on tablets, with an average of one hour daily. The mode for computer usage was 0.5 hours daily before the pandemic, while the median was

one hour. During the pandemic, computer usage by learners reached up to three hours daily, with an average of 1.65 hours. The mode was 0.5 hours daily during the pandemic, while the median was one hour. The variance of the data relating to before and during the pandemic, was 0.35 and 1.58 respectively - which indicates a larger degree of dispersion between responses for during the pandemic. The standard deviation before and during the pandemic, was 0.59 and 1.25 respectively - which also shows a slightly larger dispersion of the responses around the mean during the pandemic.

4.3.6 Educational games / Google Classroom

Parents reported that only thirty-nine learners used electronic devices for educational purposes before the pandemic, which increased to fifty-four learners during the pandemic. The total number of hours spent on electronic devices for educational purposes by the learners before the pandemic amounted to 76.5 hours daily, which increased to 118 hours during the pandemic. Electronic device usage for educational purposes, therefore, increased by 54.2 per cent during the pandemic. Before the pandemic, learners spent up to four hours on electronic devices for educational purposes, with an average of 1.96 hours daily. The mode was 0.5 hours daily before the pandemic, while the median was two hours. During the pandemic, electronic device usage for educational purposes by learners also reached up to four hours daily, with an average of 2.18 hours. The mode was one hour daily during the pandemic, while the median was two hours. The variance of the data relating to before and during the pandemic, was 1.73 and 1.66 respectively - which indicates a degree of dispersion between responses which is very close to one another. The standard deviation before and during the pandemic, was 1.31 and 1.29 respectively - which also shows an almost similar dispersion of the responses around the mean.

4.3.7 Parent and child engaged with electronic devices together

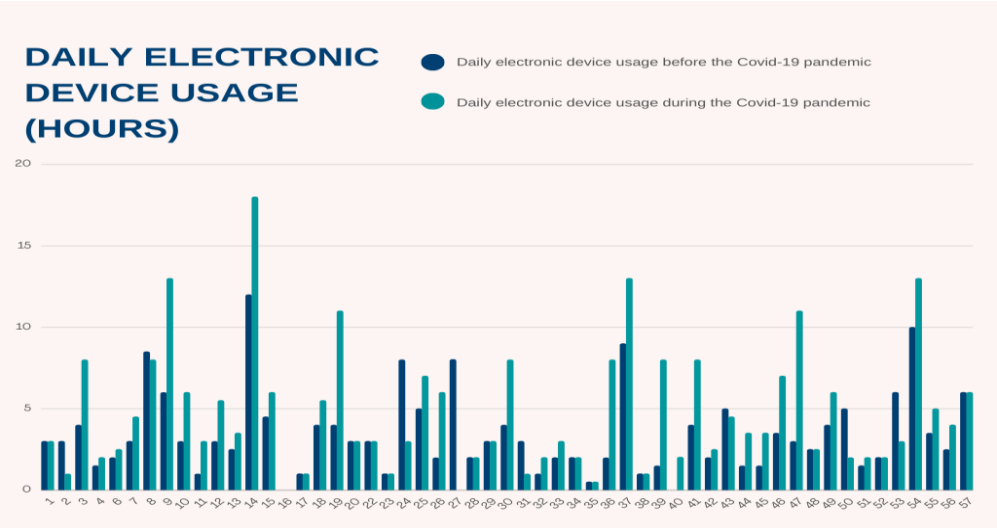
According to the responses, all parents indicated that they are engaged with electronic devices with their children. The total number of hours spent engaged with devices together before the pandemic amounted to 101 hours daily, which increased to 139 hours during the pandemic. Electronic device usage together by parents and children, therefore, increased by 37.6 per cent amid the pandemic. Before the pandemic, parents and learners spent up to six hours on electronic devices together, with an

average of 1.83 hours daily. The mode and median for were two hours daily before the pandemic. During the pandemic, electronic device usage by learners and parents was reported to reach over six hours daily, with an average of 2.43 hours. The mode was three hours, while the median was two hours daily during the pandemic. The variance of the data relating to before and during the pandemic, was 1.53 and 2.46 respectively - which points to a larger degree of dispersion between responses during the pandemic. The standard deviation before and during the pandemic, was 1.23 and 1.57 respectively - which indicates a slightly larger dispersion of the responses around the mean during the pandemic.

4.3.8 Total daily screen time

The total daily screen time of the fifty-seven learners before the pandemic amounted to 198 hours, which increased to 280.5 hours amid the pandemic. The total daily screen time of learners, therefore, increased by 41.6 per cent during the pandemic. Figure 4.1 shows the daily electronic usage by the respondents in hours.

Figure 4.1: Daily Electronic Device Usage (Hours)
Source: Self-generated from data collection



Before the pandemic, some learners used electronic devices for up to 10 hours daily, with an average of 3.6 hours daily. The mode and median for daily screen time were three hours before the pandemic. During the pandemic, daily screen time reached up to eighteen hours daily for some learners, with an average of five hours. The mode was three hours daily during the pandemic, while the median was 3.5. The variance

of the data relating to before and during the pandemic, was 5.90 and 14.17 respectively - which points to a very large degree of dispersion between responses for before and during the pandemic. This indicates that some learners are exceptions and engage more with electronic devices than the average learner. The standard deviation before and during the pandemic, was 2.42 and 3.76 respectively - which points to a slightly larger dispersion of the responses around the mean during the pandemic. It is clear that the amount of time spent on electronic devices increased significantly during the pandemic.

4.4 The levels of electronic device usage by learners during the COVID-19 pandemic

4.4.1 Minimal usage

Learners who made use of electronic devices for up to two hours daily during the pandemic, were categorised as minimal usage participants. Responses from parents indicated that sixteen learners fell into the minimal usage category. These sixteen learners accounted for 21.5 hours and 7.66 per cent of the total daily electronic device usage reported in the Screen time Questionnaire. The mean for the minimal usage group was 1.34 hours of daily screen time amid the pandemic. The mode was two hours daily, while the median was 1.5 hours. The variance for the group was 0.52, which indicates that the responses within the group has a small degree of dispersion. The standard deviation for the group is 0.72, which indicates that the responses within the group are dispersed closely to the mean.

4.4.2 Average usage

Learners who made use of electronic devices for between two to six hours daily during the pandemic, were categorised as average usage participants. Responses from parents indicated that twenty learners fell into the average usage category. These twenty learners accounted for 71 hours and 25.3 per cent of the total daily electronic device usage reported in the Screen Time Questionnaire. The mean for the average usage group was 3.55 hours of daily screen time amid the pandemic. The mode and median were three hours daily. The variance for the group was 0.87, which indicates that the responses within the group has a small degree of dispersion. The standard deviation for the group is 0.93, which indicates that the responses within the group are dispersed closely to the mean.

4.4.3 High usage

Learners who made use of electronic devices for upwards of six hours daily during the pandemic, were categorised as high usage participants. Responses from parents indicated that twenty-one learners fell into the high usage category. These 21 learners accounted for 188 hours and 67.02 per cent of the total daily electronic device usage reported in the Screen time Questionnaire. The mean for the high usage group was 8.95 hours of daily screen time amid the pandemic. The mode and median were eight hours daily. The variance for the group was 9.95, which indicates that the responses within the group have a very large degree of dispersion. One learner was reported to use electronic devices daily for up to eighteen hours, while others spent as much as eleven and thirteen hours on these devices. The standard deviation for the group is 3.15, which indicates that the responses within the group have a large degree of dispersion from the mean.

4.5 The impact of different levels of electronic device usage on the social development of learners

4.5.1 Social interaction with peers

4.5.1.1 Group cooperation

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of their group cooperation, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.6 (72 per cent), while the average and high usage groups had a mean of 2.9 (58 per cent) and 2.4 (48 per cent). The mode of the minimum usage group was three, while the average and high usage groups had a mode of 4 and 1, respectively. The variance for the minimum, average and high usage groups are 1.44, 1.69, and 1.84 respectively - which indicates a growing degree of dispersion between the responses within the groups. The standard deviation reflects the slightly increasing dispersion between the minimum, average and high usage groups, which are 1.2, 1.3, and 1.35, respectively.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of group cooperation. The minimum usage learners had three outliers: One learner fights often when in a group, while the other two offer minimal input. The average usage group also had two outliers:

One learner did not participate in group activities at all, while the other waited for others to contribute rather than offer a solution. The high usage group had four negative outliers and one positive. The positive outlying participant is very social and able to lead and follow in a group. The other participants were unable to work with other children; let others do the work; and are too shy to participate in group work. It is clear from the quantitative and qualitative data that the high usage learners have struggled more than the other two groups to master group cooperation skills.

4.5.1.2 Conversing with peers

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they converse with their peers, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.7 (74 per cent). In comparison, the average and high usage groups had a mean of 3.1 (62 per cent) and 2.7 (54 per cent). The mode of the minimum usage group was 3, while the average and high usage groups had a mode of 4 and 2, respectively. The variance for the minimum, average and high usage groups are 1.01, 1.09, and 1.61 respectively - which indicates a slight growing degree of dispersion between the responses within the groups. The standard deviation reflects the slightly increasing dispersion between the minimum, average and high usage groups, which are 1.00, 1.04, and 1.26, respectively.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of conversing with peers. The minimum usage learners had two comments: One learner only converses with close friends, while the other one was showing development in this skill. The average usage group had three outliers: Two learners are overly talkative in class, while the other one is very introverted. The high usage group had four outliers: Two participants are too talkative, while the other two are quiet and do not socialise. It is clear that the high usage learners have not developed this skill as well when compared to the other two groups.

4.5.1.3 Building lasting friendships

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they develop lasting friendships and handle peer pressure, which is a social skill

that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.6 (72 per cent), while the average and high usage groups had a mean of 2.9 (58 per cent) and 2.6 (52 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mode of 3 and 2, respectively. The variance for the minimum, average and high usage groups are 1.64, 0.49, and 1.44 respectively - which indicates a varying degree of dispersion between the responses within the groups. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.28, 0.7, and 1.2, respectively.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of building lasting friendships. The minimum usage learners had one comment: The learner changes friends frequently and do not sustain friendships. The average usage group also had one outlier: The learner fights often with friends. The high usage group had two comments: The two participants do not socialise with peers. The quantitative and qualitative data visibly show that the high usage learners have not developed this skill as well when compared to the other two groups.

4.5.1.4 Problem-solving, negotiating and compromising

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they use problem-solving, negotiating and compromising when interacting with peers, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.4 (68 per cent), while the average and high usage groups had a mode of 2.3 (46 per cent) and 2.1 (42 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mean of 2 and 1, respectively. The variance for the minimum, average and high usage groups are 2.44, 0.81, and 1.69 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the minimum usage learners' ratings vary the most. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.56, 0.9, and 1.3, respectively. It is clear that both the average and high usage learners have not developed this skill as well when compared to the minimum usage group.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of problem-solving, negotiating and compromising when interacting with peers. The minimum usage learners had two comments: Both learners argue with friends and struggle with compromise. The average usage group had two outliers: One learner often complains of being bullied and is often the instigator, while the other learner rather argues and fights. The high usage group had four outliers: One learner is good at sorting out problems, while the other four learners are those who complain often, keep quiet at school and complain at home, and are the cause for complaints. It is clear that the high usage learners are struggling more with problem-solving, negotiating and compromising when compared to the other groups.

4.5.1.5 Sharing with peers

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they demonstrate sharing with peers, which is a social skill that learners should develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.8 (76 per cent), while the average and high usage groups had a mean of 2.9 (58 per cent) and 3.1 (62 per cent). The mode of the minimum and average usage groups was three, while the high usage group had a mode of four. The variance for the minimum, average and high usage groups are 0.76, 0.69, and 1.29 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the minimum and average usage groups show a smaller degree of dispersion of the ratings. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 0.81, 0.83, and 1.13, respectively. It is apparent that the minimum usage demonstrates sharing with peers the best, while the average usage learners have to work on improving this skill most when compared to the other groups.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they share with peers. The minimum usage learners had one outlier: The learner does not share often but does share with friends. The average usage group had no outliers. The high usage group also had one outlier: The learner is very caring and shares often.

4.5.2 Social interaction with parents

4.5.2.1 Growing independence from parents

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they develop growing independence from their parents, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.4 (68 per cent), while the average and high usage groups had a mean of 2.3 (46 per cent) and 2.6 (52 per cent). The mode of the minimum usage group was two, while the average and high usage groups had a mode of 2 and 3, respectively. The variance for the minimum, average and high usage groups are 1.64, 1.01, and 1.44 respectively - which indicates a varying degree of dispersion between the responses within the groups. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.28, 1.00, and 1.2, respectively. It is clear that both the average and high usage learners have not made as much progress in developing this skill when compared to the minimum usage group.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of growing independence from parents. The minimum usage learners had three comments: One learner has an overly controlling parent who does not allow for opportunities to be independent; the second learner has uninvolved parents; the other learner depends on her mother to handle any issue at school on her behalf. The average usage group had five outliers: Three learners are struggling in class due to absent parents, while the other two demonstrated strong dependency on their parents who does everything for them. The high usage group had four outliers: Two learners are showing progress in this area, while the other one is very independent of her parents. It is clear that the average and high usage learners are more dependent on their parents than the minimum usage group.

4.5.3 Social play

4.5.3.1 Fantasy play and interactive games

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they participate in fantasy play and interactive games, which is a social skill that

learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.5 (70 per cent), while the average and high usage groups had a mean of 2.5 (50 per cent) and 2.6 (52 per cent). The mode of the minimum usage group was three, while the average and high usage groups had a mode of 2 and 3, respectively. The variance for the minimum, average and high usage groups are 1.45, 0.65, and 1.44 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.20, 0.86, and 1.2, respectively. It is clear that both the average and high usage learners have not mastered this skill when compared to the minimum usage group.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they participate in fantasy play and interactive games. The minimum usage learners had no outliers. The average usage group had two outliers: Both learners do not participate in these types of games. The high usage group had one outlier: The learner does not participate in these types of games. It is clear that the average and high usage learners participate less in fantasy play and interactive games.

4.5.3.2 Playing with same-gender peers

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how much they play with same-gender peers, which is a social preference that learners showcase by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 4 (80 per cent). In comparison, the average and high usage groups both had a mean of 3.2 (64 per cent). The mode of all groups was four. The variance for the minimum, average and high usage groups are 0.8, 0.56, and 0.96 respectively - which indicates a small varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 0.89, 0.74, and 0.97, respectively. It is apparent that all three groups have shown this preference to some extent, of which the minimum usage group shows a stronger preference. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners

in the group in terms of how much they play with same-gender peers. The minimum and average usage learners had no comments. The high usage group had only one comment: The learner showed no preference for gender when it comes to friends.

4.5.3.3 Playing group games with own rules

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they participate in group games and create their own rules, which is a social skill that learners demonstrate by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.5 (70 per cent). In comparison, the average and high usage groups had a mean of 2.8 (56 per cent) and 2.5 (50 per cent) respectively. The mode of the minimum and average usage groups was three, while the high usage group had a mode of two. The variance for the minimum, average and high usage groups are 1.25, 0.76, and 1.05 respectively - which indicates a small varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.11, 0.87, and 1.02, respectively. It is clear that the minimum usage group has shown the most progress in this skill when compared to the other two groups. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they participate in group games and create their own rules. The average usage and high usage learners had no comments. The minimum usage group had only two comments: One learner did not participate in these games, while the other argued about the rules. Qualitatively, the minimum usage group demonstrated more difficulties in participating in group games and creating their own rules.

4.5.4 Individual social skills

4.5.4.1 Awareness of scholastic performance

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how much they are aware of their scholastic performance, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 4 (80 per cent), while the average and high usage groups had a mean of 2.8 (56 per cent) and 3 (60 per cent). The mode of the minimum usage

group was five, while the average and high usage groups had a mode of 2 and 3, respectively. The variance for the minimum, average and high usage groups are 1.2, 0.56, and one respectively - which indicates a varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.09, 0.74, and one respectively. It is clear that both the average and high usage learners lag behind when compared to the minimum usage group.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how much they are aware of their scholastic performance. The minimum usage learners had one comment: The learner has demonstrated immense improvement. The average usage group had two outliers: One learner does not perform to his best ability and knows it, while the other learner does not do anything to improve. The high usage group had three outliers: All three learners are not performing well and making no effort to improve. It is clear that the minimum usage learners are more aware of their scholastic performance and make an effort to improve when compared to the other two groups.

4.5.4.2 Empathy and compassion

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they show empathy and compassion towards others, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.7 (74 per cent), while the average and high usage groups had a mean of 3 (60 per cent) and 2.6 (52 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mode of 4 and 1, respectively. The variance for the minimum, average and high usage groups are 1.41, 1.2, and 2.04 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the high usage group shows the highest degree of dispersion. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.18, 1.09, and 1.42, respectively. It is apparent that both the average and high usage learners did not make as much progress in developing this skill when compared to the minimum usage group.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they show empathy and compassion towards others. The minimum usage learners had one comment: The learner does not really show empathy. The average usage group had three outliers: One learner is caring towards others, while the other two learners show no emotion and laugh instead of showing remorse. The high usage group had two outliers: One learner shows no emotion, while the other does not appear to care much. It is apparent that the average and high usage learners struggle more with showing empathy and compassion towards others when compared to the minimum usage learners.

4.5.4.3 Identify and describe emotions, reflect on motives

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they can identify and describe emotions, as well as reflect on the motives of others. This is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.4 (68 per cent), while the average and high usage groups had a mean of 2.6 (52 per cent) and 2.4 (48 per cent). The mode of the minimum usage group was three, while the average and high usage groups had a mode of 3 and 1, respectively. The variance for the minimum, average and high usage groups are 1.64, 1.04, and 1.84 respectively - which indicates a varying degree of dispersion between the responses within the groups. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.28, 1.01, and 1.35, respectively. It is clear that both the average and high usage learners are developmentally behind regarding this skill when compared to the minimum usage group.

The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they could identify and describe emotions, as well as reflect on the motives of others. The minimum usage learners had two comments: One learner does not talk to anyone in the class, while the other struggles to understand the emotions of others. The average usage group had two outliers: One learner always states that nothing is wrong, while the other learner does not interact with others. The high usage group had one outlier: The learner does not react or respond to the emotions of others. It is evident that all three groups struggled with identifying and describing the emotions of others.

4.5.4.4 Demonstration of sportsmanship

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they demonstrate sportsmanship. This is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3 (60 per cent), while the average and high usage groups had a mean of 2.6 (52 er cent) and 2.1 (42 per cent). The mode of the minimum usage group was two, while the average and high usage groups had a mode of 3 and 2, respectively. The variance for the minimum, average and high usage groups are 1.6, 0.24, and 1.29 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.26, 0.48, and 1.13, respectively. It is apparent that all three groups have not yet mastered this skill. The teachers were asked to describe the social behaviour of participants that stood out from the rest of the learners in the group in terms of how well they demonstrated sportsmanship. The minimum usage learners had three comments: Two learners do not participate in sport, while the other one does not cope well with losing. The average usage group had three outliers: All three learners do not participate in any sports. The high usage group had five outliers: These learners are reportedly too emotional and do not cope well with losing. It is evident that the average and high usage groups struggled with demonstrating good sportsmanship, while some learners in the minimum usage group did not even participate in any sports.

4.5.4.5 Concern for fairness and justice

The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they show a concern for fairness and justice, which is a social skill that learners demonstrate by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.7 (74 per cent), while the average and high usage groups both had a mean of 2.8 (56 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mode of 4 and 2, respectively. The variance for the minimum, average and high usage groups are 1.21, 1.36, and 1.36 respectively - which indicates a slight varying degree of dispersion between the responses within the groups. The standard deviation reflects the slightly varied

dispersion between the minimum, average and high usage groups, which are 1.1, 1.16, and 1.16, respectively. The data shows that both the average and high usage learners have yet to demonstrate this skill properly when compared to the minimum usage group.

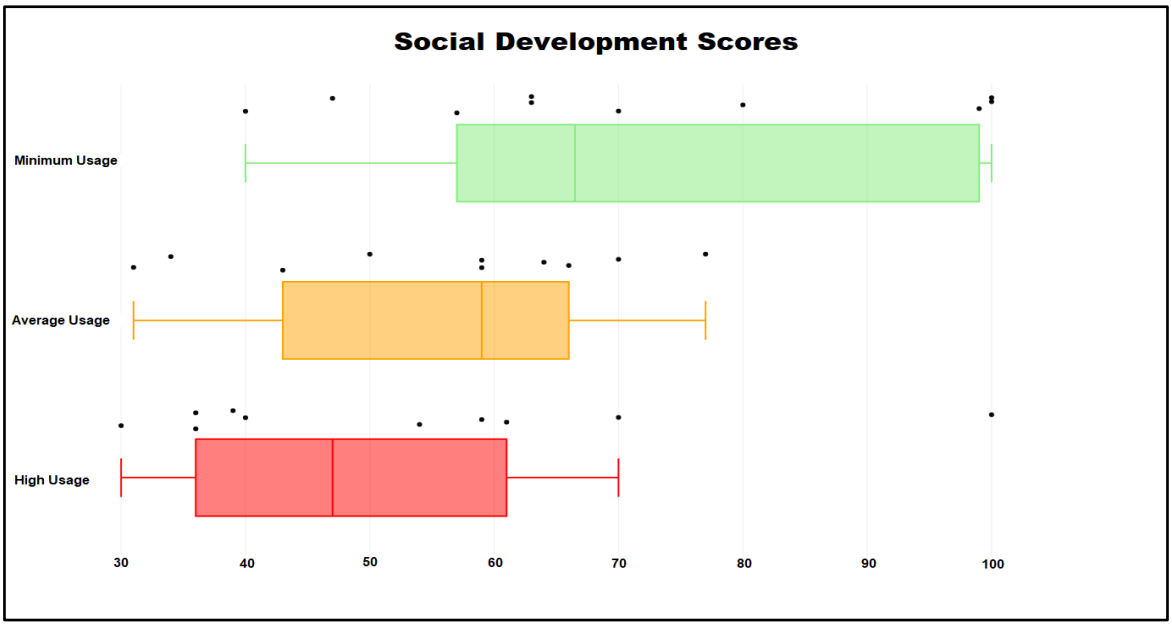
The teachers were asked to describe the social behaviour of participants that stood out from the rest of the learners in the group in terms of how well they showed concern for fairness and justice. The minimum usage learners had no outliers. The average usage group had one outlier: “The learner only cares about himself and how he is affected.” The high usage group also had one outlier: “The learner does not seem to care much about fairness and justice.” The qualitative data, therefore, suggest that the average and high usage learners showed less concern for fairness and justice.

4.5.5 Total impact on social development

The totals for the ratings of each participant were calculated and used to determine the social development of the three groups. The minimum usage group had a mean of 3.6 (72 per cent) in total, while the average and high usage groups had a mean of 2.8 (55 per cent) and 2.6 (52 per cent). The overall mode of the minimum usage group was five, while the average and high usage groups had a mode of 3 and 1, respectively. The variance for the minimum, average and high usage groups are 1.09, 0.52, and 1.02 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the average usage learners’ ratings are the most similar overall. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.04, 0.72, and 1.01, respectively. Figure 4.2 depicts the dispersion and deviation between the three groups in terms of social development scores.

Figure 4.2: Social Development Scores

Source: Self-generated based on data collected



It is evident that both the average and high usage learners have to improve on their social development skills when compared to the minimum usage group overall. The minimum usage group had the most ratings of five (Excellent), whereas the high usage group had mostly ratings of one overall.

ANOVA was calculated for the three groups to determine if the data was statistically significant at $p < 0.05$ to reject or accept the null hypothesis. Table 4.2 depicts the results of the ANOVA test for the Social Development scores.

Table 4.2: ANOVA test for Social Development

Source: Self-generated, calculated on Excel

ANOVA: Single Factor						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1078,4	2	539,2	2,810339	0,077849	3,354131
Within Groups	5180,3	27	191,863			
Total	6258,7	29				

The f-ratio was calculated at 2.81, which indicated that the variation between the means of the groups was higher than what could be expected to be seen by chance. The p-value was calculated as 0.077, therefore, the result is insignificant at $p < 0.05$ and indicates strong evidence for the null hypothesis. However, the data clearly shows

that there was an impact on the social development of the learners in the three groups, where the minimum usage group demonstrated the most progress in the development of the social skills of eight-year-olds.

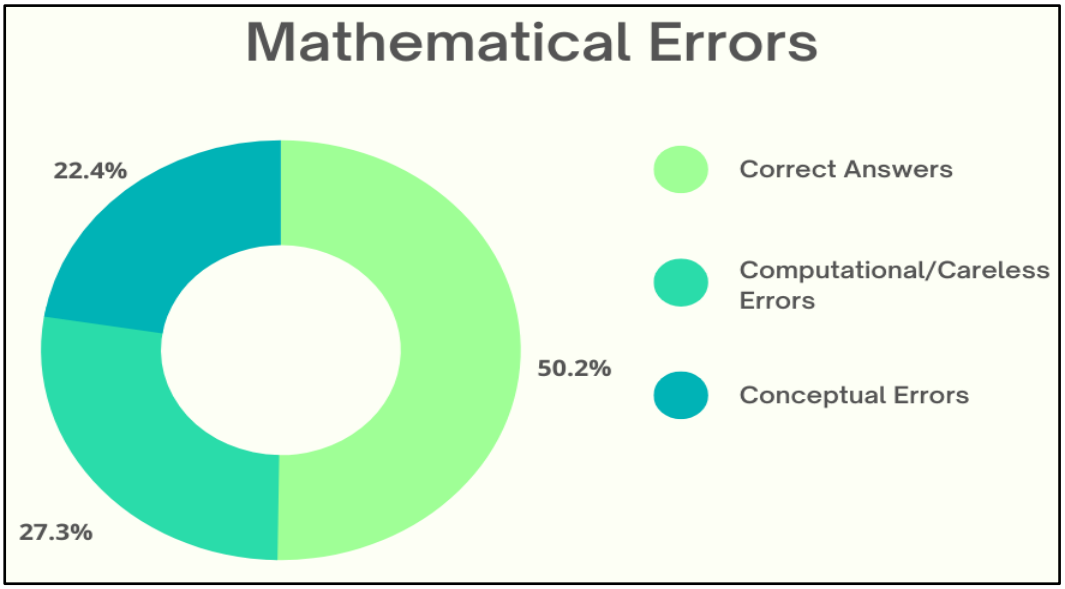
4.6 The impact of different levels of electronic device usage on the cognitive development of learners

4.6.1 Mathematical errors

The errors made by the learners were categorised as Computational/Careless errors and conceptual (comprehension) errors. Computational/Careless errors occur when learners do not pay attention or work too fast, which leads to careless errors or errors with calculations (subtracting, adding, multiplying or dividing incorrectly) (Lake, 2016). Conceptual errors are made when learners misunderstand the concepts underlying a mathematical problem and make use of incorrect logic, which therefore points to errors in comprehension (Lake, 2016). Figure 4.3 depicts the mathematical errors made by the respondents.

Figure 4.3: Mathematical Errors

Source: Self-generated based on calculations on Excel



The data indicated that 123 errors were Computational/Careless and 101 were conceptual errors. The number of conceptual errors indicates that the learners have a

lack of understanding of the mathematical concepts and have trouble reading and interpreting questions with the necessary insight. The Computational/Careless errors are evidence that learners are not yet confident in their calculations and make unnecessary mistakes.

4.6.2 Numbers, operations and relationships

4.6.2.1 Counting

The first question instructed the learners to count the number of balls (95) and use grouping to simplify the counting process. According to the Mathematics CAPS document, Grade 2 learners should be adept with counting up to 200 objects in groups of 1's, 2's, 3's, 4's and 5's (Department of Basic Education, 2011). Grade 3 learners should be able to count at least 500 objects by term 2 (Department of Basic Education, 2011). The minimum usage learners struggled with this question and only 30 per cent answered correctly. The average usage group had a success rate of 80 per cent, while the high usage group only had two (20 per cent) correct answers for Question 1. Most of the learners attempted to count the balls in 1's and eight learners made Computational/Careless errors while counting. Nine conceptual errors were made, where learners simply guessed the number of balls or wrote down an illogical number. The data suggests that learners have not yet mastered the skill of counting, even though it was a Grade 2 learning outcome, since 56.6 per cent of answers were wrong. However, the average usage group had the most success with this question.

4.6.2.2 Addition

Question 2 had learners use a context-free addition calculation to solve 154 + 179 = ☐. The Mathematics CAPS document states that Grade 2 learners should be adept with using context-free calculations, such as breaking up numbers, to solve addition sums that total 99 (Department of Basic Education, 2011). By Term 2 in Grade 3, learners should be able to calculate addition sums up to 400 (Department of Basic Education, 2011). The minimum usage learners had six (60 per cent) correct answers. The average usage group had a success rate of 80 per cent, while the high usage group only had four (40 per cent) correct answers for Question 2. The data shows that twelve Computational/Careless errors were made while learners were adding the numbers, especially when the totals were added to find the answer. The data suggests

that learners have room for improvement with addition sums since 40 per cent of answers were wrong. It is also clear that the average usage group had the most success with this question.

4.6.2.3 Multiplication

Question 3 asked learners to multiply 26 x 5 = ☐. Learners are expected to break up the number, multiply and add the answers to find the total. According to the Mathematics CAPS document, Grade 2 learners should be adept with multiplying 1 - 10 with 2, 3, and 4, with a total of 50 (Department of Basic Education, 2011). In Grade 3, learners should be adept with multiplying with 2, 3, 4, 5, and 10 to a total of 99 (Department of Basic Education, 2011). The minimum usage learners had seven (70 per cent) correct answers. The average and high usage groups had a success rate of 60 per cent for Question 3. The data shows that ten Computational/Careless errors were made while learners were adding the totals to find the answer. One participant made a conceptual error, which clearly shows that the learner did not comprehend the mathematical calculation required to solve the sum. The data suggests that learners have room for improvement with multiplication sums since 36.6 per cent of answers were wrong. The minimum usage group had a slightly higher success rate with this question.

4.6.2.4 Division

Question 4 had learners divide 69 ÷ 3 = ☐. Learners are expected to break up the number, divide and add the answers to find the total. The Mathematics CAPS document states that Grade 2 learners should be adept with breaking up numbers and divide evenly, with fifty as a maximum (Department of Basic Education, 2011). In Grade 3, learners should be able to divide any number up to 100 (Department of Basic Education, 2011). The minimum and average usage learners had six (60 per cent) correct answers. The high usage group had a success rate of 50 per cent for Question 4. The data indicates that ten Computational/Careless errors were made while learners were adding the totals to find the answer or counting incorrectly while dividing. Three participants made conceptual errors, which clearly show that they do not comprehend the mathematical calculation required to solve the sum. The data shows that learners have yet to master division sums since 43.3 per cent of answers were

wrong. The minimum and average usage groups had a slightly higher success rate with this question.

4.6.2.5 Sorting numbers

Question 5 asked the learners to sort the numbers from least to greatest (211, 112, 221, 122, 201, 222). According to the Mathematics CAPS document, Grade 2 learners should be adept with describing and sorting numbers up to 99, while Grade 3 learners can sort numbers up to 500 by term 2 (Department of Basic Education, 2011). The minimum usage learners had five (50 per cent) correct answers. The average usage group had a success rate of 60 per cent, while the high usage group only had three (30 per cent) correct answers for Question 5. The data shows that sixteen Computational/Careless errors were made while learners were sorting the numbers, namely sorting from largest to smallest and putting 201 after 112. The data suggests that learners have room for improvement with sorting numbers since 53.3 per cent of answers were wrong. It is also clear that the average usage group had slightly more success with this question.

4.6.2.6 Story sum (subtraction)

Question 6 was a story sum in which learners had to use subtraction to solve the problem (245 - 188 = ☐). The Mathematics CAPS document states that Grade 2 learners should be adept with solving contextual problems through addition and subtraction with totals of up to 99, by breaking up numbers (Department of Basic Education, 2011). By term 2, Grade 3 learners are expected to solve contextual problems with totals up to 400 (Department of Basic Education, 2011). The minimum usage learners had eight (80 per cent) correct answers. The average usage group had a success rate of 30 per cent, while the high usage group only had two (20 per cent) correct answers for Question 6. The data shows that seventeen Computational/ Careless errors were made while learners were subtracting the numbers with an arrow sum method. This method was introduced to learners in Grade 2 and was used consistently afterwards. The data suggests that learners have not yet mastered subtraction with the taught method since 56.6 per cent of answers were wrong. The minimum usage group had great success with this question.

4.6.2.7 Halving and doubling

Question 7 had learners halve 197, which required them to use a fraction (½). According to the Mathematics CAPS document, Grade 2 learners should be able to write fractions such as ½ and be able to double and halve numbers up to ninety-nine without context (Department of Basic Education, 2011). By Term 2 in Grade 3, learners should be adept with doubling and halving numbers context-free up to 500 (Department of Basic Education, 2011). The minimum and high usage learners had six (60 per cent) correct answers. The average usage group had a success rate of 40 per cent for Question 7. The data shows that twelve Computational/Careless errors were made while learners were adding the totals to find the answer or halving seven incorrectly. Two participants made conceptual errors, which clearly show that they do not comprehend the mathematical calculation required to solve the sum. The data shows that learners have to improve on halving numbers since 46.6 per cent of answers were wrong. The minimum and high usage groups had a slightly higher success rate with this question.

4.6.2.8 Money sums

Question 8 asked learners to count a collection of 5 cent, 10 cent, and 20 cent coins to a total of 165 cents or R1,65. The Mathematics CAPS document states that Grade 2 and Grade 3 learners should be adept with identifying all South African banknotes and coins, as well as be able to solve money sums with totals and change of up to R99 and 90 cents (Department of Basic Education, 2011). The minimum and high usage learners had 3 (30 per cent) correct answers. The average usage group had a success rate of 20 per cent for Question 8. The data shows that fifteen Computational/Careless errors were made while learners were counting the cents. Conceptual errors were made by seven learners, which clearly show that they do not comprehend how to count money. The data shows that learners have plenty of room for improvement on counting money since 73.3 per cent of answers were wrong. The minimum and high usage groups had a slightly higher success rate with this question but still struggled immensely.

4.6.3 Patterns, functions and algebra

4.6.3.1 Number patterns

Question 9 had learners complete a number pattern by counting in 4's from 141 to 169. According to the Mathematics CAPS document, Grade 2 learners should be adept with copying, extending and describing easy number patterns up to 200 (Department of Basic Education, 2011:24). By Term 2 in Grade 3, learners should be able to count onward and backwards from any number up to 500 in 1's, 2's, 3's, 4's, 5's, and 10's (Department of Basic Education, 2011). The minimum usage learners had three (30 per cent) correct answers. The average and high usage groups had a success rate of 50 per cent for Question 9. The data indicates that seventeen Computational/ Careless errors were made while learners were counting on in 4's. It is evident that learners have yet to master counting in even and uneven number patterns since 56.6 per cent of answers were wrong. The minimum and high usage groups had a slightly higher success rate with this question but still struggled.

4.6.4 Space and shape

4.6.4.1 Naming 3-D shapes

Question 10 featured a picture of a pyramid for which learners had to name the Three-Dimensional Shapes (3-D). The Mathematics CAPS document states that Grade 2 learners should be adept with recognising and naming 3-D shapes such as balls, boxes and cylinders (Department of Basic Education, 2011). By the end of Grade 3, learners should be adept with identifying and naming pyramids and cones as well (Department of Basic Education, 2011). The Grade 2 and 3 teachers confirmed that they taught the learners all of the 3-D shapes in Grade 2 and do revision on all of the shapes continuously. The minimum usage learners had five (50 per cent) correct answers. The average usage group had a success rate of 30 per cent, while the high usage group had four (40 per cent) correct answers for Question 10. The data shows that eighteen conceptual errors were made - most of the learners identified the shape as a cone, which indicates a lack of understanding of the properties of 3-D shapes. The data suggests that learners have to work more concretely with 3-D shapes since 60 per cent of answers were wrong. It is also apparent that the minimum usage group had slightly more success with this question.

4.6.4.2 Properties of 3-D shapes

Question 11 featured a picture of a cube and asked learners to describe the properties of the shape in terms of rolling or gliding. According to the Mathematics CAPS document, Grade 2 and Grade 3 learners should be adept with sorting 3-D shapes corresponding to their properties, such as rolling or gliding (Department of Basic Education, 2011). The minimum usage learners had seven (70 per cent) correct answers. The average usage group had a success rate of 60 per cent, while the high usage group had eight (80 per cent) correct answers for Question 11. The data shows that nine conceptual errors were made - some learners answered “no”, which indicates a lack of understanding of the question and the properties of 3-D shapes. The data suggests that some learners have to experience the 3-D shapes concretely since 30 per cent of answers were wrong. It is also apparent that most of the learners could answer this question, but the average usage group had slightly less success with this question.

4.6.4.3 Symmetry

Question 12 asked learners to draw a line of symmetry on a picture of an arrow. The Mathematics CAPS document states that Grade 2 learners should be adept with recognising and drawing lines of symmetry on 2-D shapes (Department of Basic Education, 2011). By term two of Grade 3, learners should be able to identify the line of symmetry through folding the paper and reflection (Department of Basic Education, 2011). The minimum and average usage learners had seven (70 per cent) correct answers. The high usage group had a success rate of 80 per cent for Question 12. The data indicates that three Computational/Careless errors were made, where learners drew the line off-centre. Five conceptual errors were made, where learners drew no line and did not know what a line of symmetry meant. It is clear that learners had more success in this question since only 26.6 per cent of answers were wrong. The high usage group had a slightly higher success rate with this question.

4.6.5 Measurement

4.6.5.1 Time

Question 13 featured an analogue clock showing the time as half past four and learners had to say what time it was. According to the Mathematics CAPS document,

Grade 2 and Grade 3 learners should be able to tell the analogue time in hours, minutes, half past, quarter past and quarter to (Department of Basic Education, 2011:29). The minimum usage learners had seven (70 per cent) correct answers, while the average usage group had nine (90 per cent). The high usage group had a success rate of 100 per cent for Question 13.

The data indicates that three Computational/Careless errors were made, where learners answered hastily and wrote down half past three. Only one conceptual error was made, where the learner wrote down an irrelevant time reading. It is evident that learners had more success in this question since only 13.3 per cent of answers were wrong. The high usage group had a slightly higher success rate with this question.

4.6.5.2 Mass

Question 14 asked learners to identify and circle two instruments that are used for measuring mass. The Mathematics CAPS document states that Grade 2 learners should be adept with measuring, sorting and recording mass by using informal measuring instruments and a bathroom scale (Department of Basic Education, 2011). By term 2, Grade 3 learners should be able to use bathroom and kitchen scales for measuring mass (Department of Basic Education, 2011). All three groups had three (30 per cent) correct answers for Question 14. The data shows that twenty-one conceptual errors were made - most of the learners circled only one of the scales, while the others circled instruments used to measure length. The data suggests that learners have to work more concretely with mass measurement since 73.3 per cent of answers were wrong. It is therefore apparent that all groups struggled with this question.

4.6.6 Data handling

4.6.6.1 Analysis of data

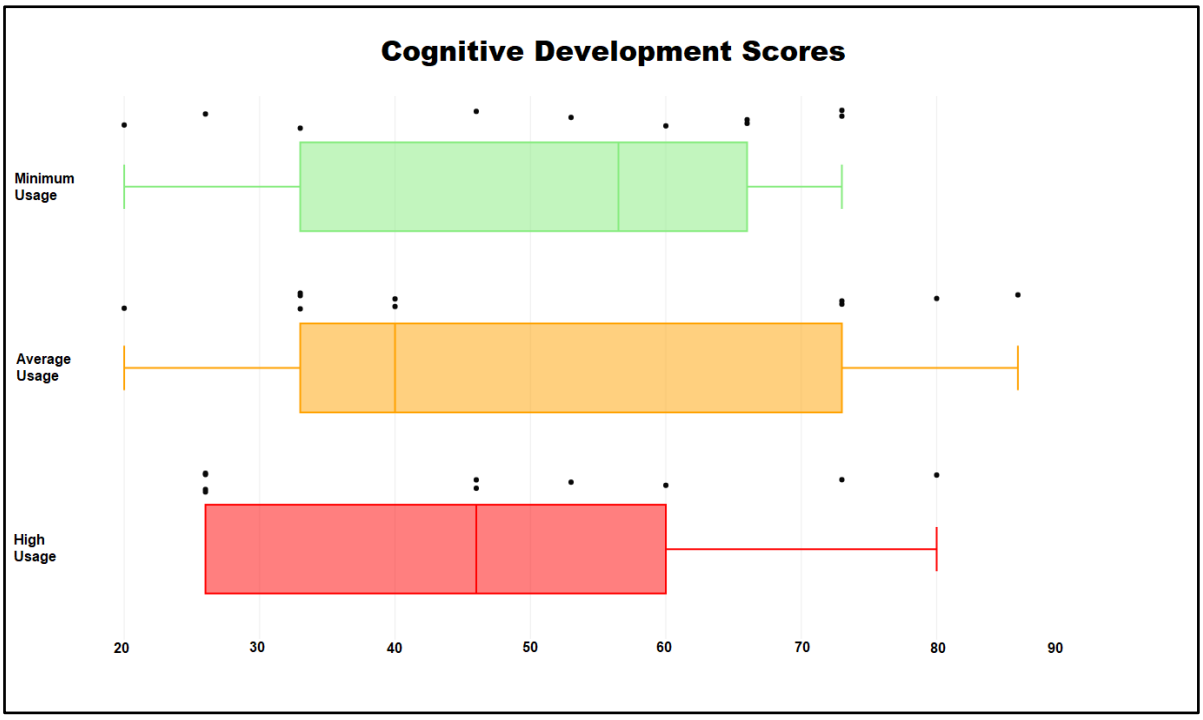
Question 15 had learners analyse a bar graph and identify the two children who read between five and ten books. According to the Mathematics CAPS document, Grade 2 learners should be able to answer questions about data in pictographs, while Grade 3 learners should be able to analyse bar graphs as well (Department of Basic Education, 2011:35). The Grade 2 and 3 teachers confirmed that learners were introduced to bar graphs in Grade 2, and Grade 3 teachers practised bar graph analysis frequently in

terms 1 and 2. The minimum usage learners had three (30 per cent) correct answers. The average and high usage groups had a success rate of only 10 per cent for Question 9. The data indicates that twenty-five conceptual errors were made. Most of the learners only mentioned one of the children who read between five and ten books or only had one correct name listed alongside an incorrect one. It is evident that learners have to work hard on reading and analysing data with insight since 83.3 per cent of answers were wrong. The minimum usage group had a slightly higher success rate with this question but still struggled immensely.

4.6.7 Total impact on cognitive development

The totals for each participant were calculated out of fifteen and used to determine the cognitive development of the three groups. The minimum usage group had a mean of 52 per cent in total, while the average and high usage groups had a mean of 51.3 per cent and 46.7 per cent respectively. The overall mode of the minimum usage group was eleven, while the average and high usage groups had a mean of 5 and 4, respectively. The variance for the minimum, average and high usage groups are 7.76, 11.81, and 8.2 respectively - which indicates a large varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the least similar overall and have the most outliers. The standard deviation reflects the large, varied dispersion between the minimum, average and high usage groups, which are 2.76, 3.43, and 2.86, respectively. Figure 4.3 depicts the dispersion and variance of scores between the three groups.

Figure 4.3: Cognitive Development Scores
Source: Self-generated based on calculations on Excel



It is evident that both the minimum and average learners performed slightly better on their cognitive development test when compared to the high usage group overall. The number of errors made by the three groups was 71, 73, and 80 respectively - which is a clear indication that online teaching and a lack of in-person teaching have impacted the cognitive development of these learners and shows that they are not performing as they should at Grade 3 level.

ANOVA was calculated for the three groups to determine if the data is statistically significant at $p < 0.05$ to reject or accept the null hypothesis. Table 4.3 depicts the ANOVA test for Cognitive Development.

Table 4.3: ANOVA test for Cognitive Development

Source: Self-generated on Excel

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3,8	2	1,9	0,184732	0,832369	3,354131
Within Groups	277,7	27	10,28519			
Total	281,5	29				

The f-ratio was calculated at 0.18 and the p-value is 0.83, therefore, the result is insignificant at $p < 0.05$ and indicates strong evidence for the null hypothesis. However, the data clearly shows that there is a severe impact on the cognitive development of the learners in the three groups, even though the levels of device usage had no significant impact. The Grade 3 learners have not mastered the skills for Grade 2 and evidently are not performing as expected in Grade 3.

4.7 Summary

This chapter presented the analysis of the data from the three questionnaires, namely the screen-time, Social Development and Cognitive Development questionnaires. The analysis of the data provided answers to the five research questions, which enables the researcher to answer the main research question and address the hypothesis. The data was collected from fifty-seven respondents, which was then refined to 10 per device usage level.

The time spent by Grade 2 (Grade 3 in 2022) learners on the different electronic devices was analysed first and the data revealed a 41.6 per cent increase in total daily screen time from before the pandemic to amid the pandemic. Before the pandemic, the learners spent an average of 3.6 hours daily on electronic devices. In comparison, learners spent an average of five hours daily on electronic devices.

The following section discussed the levels of electronic device usage by learners during the COVID-19 pandemic. Learners who used electronic devices for up to two hours daily, were categorised as minimum usage. Responses from parents indicated that sixteen learners fall into the minimum usage category. The average electronic device usage group referred to learners who spend between two to six hours on these devices and twenty learners fell into this category. Learners who used electronic devices for more than six hours daily, were categorised as high usage learners. Responses from parents indicated that twenty-one learners fell into this group.

The section that followed focused on the impact of different levels of electronic device usage on the social development of learners. Each question was analysed individually and the section concluded with the total impact of electronic device usage on social

development. The total for the social development ratings by the Grade 3 teachers for each group of ten learners was calculated and the minimum usage group showed the most progress in social development with a group average of 72 per cent. The average and high usage groups had averages of 55 per cent and 52 per cent respectively for social development, which is considerably less than the minimum usage group. However, the ANOVA had a p-value of 0.077 indicates that the impact of the levels of electronic device usage on the social development of Grade 2 (Grade 3 in 2022) is not statistically significant and suggests strong evidence for the null hypothesis.

The impact of different levels of electronic device usage on the cognitive development of learners was analysed next. The mathematical errors made by the participants were categorised as Computational/Careless errors and conceptual errors. Only 50.2 per cent of answers were correct in total for the mathematics achievement test, while Computational/Careless errors formed 27.3 per cent of the possible total, and conceptual errors made up the final 22.4 per cent. The data was analysed per question and finally as a total impact on cognitive development. The average score for the minimum usage group was 52 per cent, followed by the average and high usage groups with scores of 51.3 per cent and 46.7 per cent respectively. However, the ANOVA had a p-value of 0.83, which indicates that the impact of the levels of electronic device usage on the cognitive development of Grade 2 (Grade 3 in 2022) is not statistically significant and suggests strong evidence for the null hypothesis.

Chapter 5 will discuss the research findings and conclusions drawn by the researcher, as well as the study's limitations.

CHAPTER 5: CONCLUSIONS AND IMPLICATIONS

5.1 Introduction

Chapter 4 contained an in-depth discussion of the data collection process and results. This final chapter will present and explain the conclusions drawn from the study and summarise the answers to the research questions and hypotheses. The first section will summarise the key findings from the study and provide answers to the research questions and hypotheses. The following section will present the research outputs and main contributions of the study, while also discussing the study in relation to the Albert Bandura's Social Cognitive theory of Albert Bandura, and how these findings can be applied in reality. The next section will discuss the limitations and shortcomings of the study. Finally, recommendations for future research will be made based on the limitations of the study. The chapter will conclude with a summary of the content.

5.2 Key findings from the study

This study aimed to examine the impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development. This section addresses the key findings from the study for each one of the research aims and questions.

5.2.1 The amount of time spent by Grade 2 learners on electronic devices before the pandemic

The first study aim was to establish the amount of time that Grade 2 learners spent on electronic devices before the pandemic. The electronic devices included televisions, MP3 players, cell phones, tablets, video game consoles, and computers. The data was collected from fifty-seven parents, who reported on the time that the learners spent on electronic devices before the pandemic. The total daily screen time of these learners added up to 198 hours. Some learners spent up to ten hours daily on electronic devices, while the group average was 3.6 hours daily. Television viewing and cell phone usage took up the majority of hours that learners spent on electronic devices daily before the pandemic. Learners watched up to five hours of television daily, as well as spent five hours daily on cell phones. The daily average for the group was 1.89 hours and 1.39 hours for television viewing and cell phone usage, respectively. Parents also reported that thirty-nine learners used electronic devices for educational purposes before the pandemic, which amounted to 76.5 hours daily for

the group. Parents also indicated that all of them are engaged with electronic devices, together with the learners, which was a total of 101 hours daily for the group and an average of 1.83 hours per learner.

5.2.2 The amount of time spent by Grade 2 learners on electronic devices during the pandemic

The second study aim was to establish the amount of time that Grade 2 learners spent on electronic devices amid the COVID-19 pandemic. The data collected from the fifty-seven parents amounted to a total daily screen time of 280.5 hours during the pandemic, which indicates an increase of 41.6 per cent in daily screen time. During the pandemic, some learners spent up to 18 hours daily on electronic devices, while the group average was 5 hours daily. Television viewing increased by 37.3 per cent during the pandemic, while cell phone usage increased with 41.5 per cent. Learners watched more than 6 hours of television daily, as well as spent more than six hours daily on cell phones. The daily average for the group was 2.5 hours and 1.5 hours for television viewing and cell phone usage respectively during the pandemic. Parents also indicated that all of the learners used electronic devices for educational purposes during the pandemic, which amounted to 118 hours daily for the group and an increase of 54.2 per cent. The amount of time that parents were engaged with electronic devices, together with the learners, increased by 36.7 per cent, which totalled 139 hours daily for the group and an average of 2.43 hours per learner.

5.2.3 The levels of electronic device usage by Grade 2 learners

The third study aim was to categorise learners into different levels of electronic device usage (minimal usage = one to two hours daily, average usage = three to five hours daily, high usage = 6+ hours daily). The responses from parents indicated that sixteen learners fell into the minimal usage category and accounted for 21.5 hours (7.66 per cent) of the total daily screen time from the Screen time Questionnaire. The data from the questionnaire indicated that twenty learners could be categorised as average electronic device usage and accounted for 71 hours (25.3 per cent) of the total daily screen time. The high electronic device usage group included the remaining twenty-one learners, who accounted for 188 hours (67.02 per cent) of the total daily screen time. The high usage group had a shocking average daily screen time of 8.95 hours.

Purposive random sampling was implemented to select ten learners per group to participate in the remaining two questionnaires.

5.2.4 The impact of the different levels of electronic device usage on the social development of Grade 2 learners

The fourth study aim was to evaluate the impact of different levels of electronic device usage on the social development of learners. The Grade 2 (Grade 3 in 2022) learners' Grade 3 teachers participated in the Social Development Questionnaire and rated the social development of learners on a scale of 1 (Poor) to 5 (Excellent). The teachers could also add additional qualitative comments regarding the social development of learners with the semi-closed ended questions. The main categories of social development were social interaction with peers and parents, social play, and individual social skills. All of these social development skills are normally developed by age eight (Grade 2) and these learners were all in Grade 3 at the time of participation (Kid Central, 2018:1). The data collected from the Social Development Questionnaire indicated that the minimum usage group had an average rating of 3.6 (72 per cent) for overall social development, while the average and high usage groups had an average score of 2.8 (55 per cent) and 2.6 (52 per cent), respectively. The minimum usage group had the highest rating of 5 (Excellent), while the average and high usage groups had a mode of 3 (Good) and 1 (Poor), respectively. The variance for the minimum, average and high usage groups were 1.09, 0.52, and 1.02, respectively - which indicates a varying degree of dispersion between the responses within the group, where the average usage learners' ratings are the most similar overall.

The qualitative data supported the quantitative data in describing the underdeveloped social skills of the learners. The teachers noted that some learners average and high usage learners were not socialising with peers and were very shy. The average and high usage learners were also noted to be very dependent on their parents and had parents who did everything for them.

The teachers remarked that some of the average and high usage learners did not participate in fantasy play and others struggled to play with other children when making up their own games and rules - which often led to fighting. In terms of individual social skills, the average and high usage learners were aware of their academic

performance, but no effort was put in to improve. Some of the average and high usage learners did not display empathy or remorse and struggled with identifying emotions of others. The teachers also noted that all three groups had learners who did not participate in any sports and did not cope well with losing. The qualitative data therefore indicates that the average and high usage learners had more challenges with social development than the minimum usage group.

5.2.5 The impact of the different levels of electronic device usage on the cognitive development of Grade 2 learners

The fifth study aim was to evaluate the impact of different levels of electronic device usage on the cognitive development of learners. The learners participated in a mathematics achievement test (Cognitive Development Questionnaire), which had questions that covered the five main categories, as stated in the Curriculum and Assessment Policy Statement (CAPS) for Basic Education. These categories are Numbers, Operations, and Relationships; Patterns, Functions, and Algebra; Space and Shape; Measurement; and Data Handling. Most of the questions formed part of the Grade 2 curriculum and all of these areas are covered by term two of Grade 3. The two main types of mathematical errors were also identified, and mistakes made by learners were categorised accordingly, namely Computational/Careless errors and conceptual errors. The data from the Cognitive Development Questionnaire indicated that 123 errors were Computational/Careless (27.3 per cent of answers) and 101 errors were conceptual (22.4 per cent of answers). The remaining 50.2 per cent of answers were correct. This is a clear indication that the learners struggled with understanding the mathematical concepts and reading with insight and made careless mistakes when completing calculations, even though most of the questions covered Grade 2 work (Lake, 2016).

The total for each participant was calculated out of fifteen, to determine the cognitive development of the three groups. The average scores of the minimum, average and high usage groups were 52 per cent (71 errors), 51.3 per cent (73 errors), and 46.4 per cent (80 errors), respectively. The overall modes for the minimum, average and high usage groups were 11, 5, and 4 out of 15, respectively. The variance for the minimum, average and high usage groups were 7.76, 11.81, and 8.2, respectively.

This indicated a very large varying degree of dispersion between the responses within the groups. It is evident that the minimum and average usage groups fared slightly better than the high usage group in the mathematics achievement test, even though all three groups made numerous errors in their calculations, based on work that was mostly covered in Grade 2 and the learners were not performing well on Grade 3 level yet.

5.2.6 The impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development

The main question and hypothesis for the study was to determine if electronic device usage by Grade 2 learners during the COVID-19 pandemic had an impact on their socio-cognitive development. The Social and Cognitive Development Questionnaires were both subjected to ANOVA to determine if the data was statistically significant at $p > 0.05$ to reject or accept the null hypothesis. The f-ratio for the Social Development Questionnaire was calculated as 2.81, which points to a higher variation between the means of the groups than what could be seen by chance. The p-value is 0.077, therefore, the result is not statistically significant at < 0.05 and indicates strong evidence for the null hypothesis. However, the data clearly shows that there is a definite impact on the social development of learners, where the minimum usage group demonstrated the most progress in social skills development of eight-year-olds.

The f-ratio for the Cognitive Development Questionnaire was calculated as 0.18, while the p-value was 0.83. The result is, therefore, not statistically significant at $p < 0.05$ and also indicates strong evidence for the null hypothesis. However, the data clearly indicates that cognitive development in terms of mathematics is impacted immensely, since the learners were only able to answer 50.2 per cent of the questions correctly overall. It is apparent that the learners have yet to master the mathematical cognitive development skills of Grade 2 and are underperforming in Grade 3.

5.3 Research outputs and main contributions of the study

This study addressed the fact that previous studies mainly outside of South Africa have explored the numerous implications of electronic device usage on the development of learners. These studies showed that the socio-cognitive development of learners may be impacted negatively. The COVID-19 pandemic has possibly increased media

exposure of learners due to quarantine at home and online learning. It was therefore necessary to study the impact of electronic devices on the socio-cognitive development of Grade 2 (Grade 3 in 2022) learners in South Africa.

The study indicated that there is an impact related to the levels of electronic device usage by learners on their socio-cognitive development, even though the results are not considered statistically significant and support the null hypothesis. In terms of social development, the minimum, average and high usage groups scored 72, 55, and 52 per cent respectively - which indicates that the minimum usage group demonstrated the most progress in the social development skills of eight-year-olds. In terms of cognitive development, the minimum, average and high usage groups scored 52, 51.3 and 46.4 per cent respectively in the mathematics achievement test. It is important to note that the mathematics sums were mostly taken from the Grade 2 CAPS, up until term two of Grade 3 - which indicates that all groups of learners are experiencing numerous negative implications with their mathematical calculations. It is also noteworthy that online learning and a lack of face-to-face classroom teaching play a fundamental role in the delay of the socio-cognitive development of learners.

This study specifically addressed three gaps in existing research. The first gap was the lack of studies about the impact of electronic devices on the socio-cognitive development of learners in South Africa. Previous studies were done in Singapore, Saudi Arabia, North America, UK, and Australia, to name a few (Tung, 2016; Al Sagr & Al Sagr, 2020; Marsh *et al.*, 2020). This study specifically addressed the impact of electronic devices on the social and cognitive development of learners in South Africa, with a focus on learners in Cradock in the Eastern Cape.

The second gap in the existing research was the lack of studies about the impact of electronic devices on the socio-cognitive development of Grade 2 learners (Grade 3 in 2022), who are eight and nine-year-olds. Previous studies focused on children younger than two, under five, aged six to seven, nine to eleven and learners older than twelve (Gottschalk, 2019; Kaur *et al.*, 2019; Lin, 2019; Tumbokon, 2020). This study specifically focused on learners who were in Grade 2 in 2021, and who were in Grade 3 in 2022 when the data was collected. These learners are all between eight and nine years of age. The socio-cognitive development skills of eight-year-olds and Grade 2 mathematics were the foundation for the questions in the related questionnaires.

The third gap is the impact of the COVID 19 pandemic on the amount of electronic device usage by learners, which is a very recent event. One South African study noted that the COVID 19 pandemic has led to excessive screen time, however, this study did not mention how much screen time has increased or what devices are used (Chetty *et al.*, 2020). Some studies have been done in North America, UK, Germany, India, and China. All of these studies mentioned an increase in electronic device usage and suggested that various aspects of childhood development may be impacted negatively (Wiederhold, 2020; Wunsch *et al.*, 2021; Dray, 2020; Dutta *et al.*, 2020; Xiang *et al.*, 2020). This study specifically analysed the different electronic devices that learners use and compared the screen time of each device before and during the pandemic. This enabled the researcher to calculate the increase in screen time amid the COVID-19 pandemic.

The SCT was the framework for the study, which is grounded in social observational learning and cognitive processing (Schunk & DiBenedetto, 2020). This theory was applied to help determine how the usage of electronic devices affected the socio-cognitive development of Grade 2 learners (Grade 3 in 2022), on the basis that children learn in the context of social relationships and modelled behaviour (Kara, 2018). The results from the study indicated that the lack of in-person teaching, social interaction and heightened screen time amid the pandemic impacted the socio-cognitive development of learners. The cognitive development of the learners was impacted the most, which is evident in the scores of the groups in the mathematics achievement test. The data suggests strong evidence that social classroom learning is critical for the socio-cognitive development of learners and that the pandemic impacted these developmental skills negatively. Therefore, this study supports Albert Bandura's Social Cognitive Theory of and its relevance in education.

The findings of this study can be applied in the real world and will benefit the learners, parents, teachers and the Basic Department of Education. The parents of the learners will gain insight into the severity of the socio-cognitive delays that their children face. Parents are the teachers at home and can research activities to do with their children to improve the social and cognitive skills that are not yet progressing as expected for their age. Parents can also directly teach and model social skills such as sharing, problem-solving, negotiating, and compromising. The teachers can plan for

interventions and directly teach social and cognitive skills. The teachers can do more revision of Grade 2 mathematics concepts in concrete and semi-concrete activities, which can help learners to gain a better understanding of those concepts that are the foundation for the Grade 3 mathematical calculations. These mathematics activities can be done in groups to encourage social interaction and learning, which enables learners to construct their own knowledge and learn from peers. The teachers can also include more group activities when teaching new concepts and demonstrations. Social skills like describing emotions, demonstrating empathy, and group cooperation can be modelled in the classroom and practised in groups. The DBE can inform all South African schools of the impact of the COVID-19 pandemic and increased electronic device usage on the socio-cognitive development of learners. The DBE should formulate an intervention plan or a curriculum enrichment programme, which specifically focuses on improving the socio-cognitive skills of all learners. This will support teachers in preparing learners for becoming successful and holistically functional 21st century members of society.

5.4 Limitations and shortcomings of the study

This study had a few limitations and shortcomings. The first limitation was the lapse of time since the conceptualisation of the first chapter and gaining ethical clearance for the project. The research was intended to focus on the Grade 2 learners and their socio-cognitive development. These learners missed approximately five months of face-to-face teaching in their Grade 1 year. However, ethical clearance was granted by the end of 2021, and by that time, the literature review and methodology chapters had not yet been completed. The data collection took place in May 2022, by which time the learners were in Grade 3. The Social Development Questionnaire still focused on the skills of eight-year-olds, while the cognitive development questionnaires contained mostly mathematical sums and concepts from Grade 2 and a few calculations taught to learners by term two of Grade 3. The lapse in time may also have influenced the answers given by parents regarding the electronic device usage by the learners, since more than eighteen months have passed since the National Lockdown in South Africa.

The second limitation was the overall sample sizes for the project. The Screen time Questionnaire collected 57 valid responses from parents, out of the 108 possible

responses. These 57 responses reflected the population of the town and all races were represented. The sampling size for the minimum, average and high usage groups were ten learners per group. This sample size appeared to be insufficient for ANOVA and the differing variances in the groups reflected the underlying reasons why the effect of different levels of electronic device usage on the socio-cognitive development of learners was statistically insignificant and supported the null hypotheses. This could have been avoided if the researcher had allowed all of the fifty-seven learners to participate in the social and cognitive questionnaires and selected the ten learners per group who had the most similar responses. This selection would have lessened the variance between the learners within the groups.

The last limitation was the social desirability of answers given by the parents and the teachers. Both the teachers and parents were encouraged to answer the questionnaires honestly, since it was guaranteed that the names of the learners would be discussed outside of the study. Parents and teachers may have felt inclined to soften responses, for fear of what the researcher may think of the learners and their social development and screen time behaviours. The researcher could address this limitation by following up on these questionnaires with adapted questions for their age and developmental level when the learners progress to the next grade and have new teachers.

5.5 Recommendations for future research

This research topic and its limitations experienced in the study offers a few recommendations for future research. The time lapse limitation can be remedied and improved upon by doing a longitudinal study on the participants. The socio-cognitive development and screen time behaviours of these learners can be recorded yearly until these learners complete high school. This research will then track the socio-cognitive development of the learners and indicate whether they overcome the delays in their socio-cognitive development or if they remain underdeveloped in socio-cognitive skills, according to their ages and stages of development.

The second recommendation would be to sample data from a much larger population than one grade group at one school. All of the schools in a town could be invited to participate, or even all schools in a province. This will enable the researcher to

generalise the findings to the population of the country with ease. The research could even go as far as including schools from all nine provinces and comparing the data between provinces, to determine if the impact of electronic device usage amid the COVID-19 pandemic on the socio-cognitive development varies between provinces or the various school communities and suburbs. This research will then inform the DBE of the nation-wide impact of electronic device usage on the socio-cognitive development of learners.

The third research recommendation is for the learners self-report on their electronic device usage behaviours and socio-cognitive development. The questionnaires could be created in such a way that the choices made by the learners reflect their development in the socio-cognitive area, by testing the skills relevant to their age and developmental stage. This will eliminate the social desirability of answers from parents and teachers. However, the learners may also try to answer in a manner that they think is expected of them.

The fourth suggestion is to assess the impact of electronic device usage during the COVID-19 pandemic on the emotional and physical development of learners. This research could inform parents, teachers and the DBE of the emotional and physical developmental delays that learners face. This future research could then be viewed in conjunction with the conclusions from this study and could then be used to form a holistic representation of all areas of childhood development impacted by electronic device usage during the pandemic.

Finally, future research could take an in-depth look at the impact of online learning amid of the COVID-19 pandemic on the scholastic performance of learners. This study recognised that online teaching formed part of the delays in development. Future studies could focus on how great the impact of online learning is on all subjects in the Foundation Phase (Home Language, First Additional Language, Mathematics, and Life Skills) and suggest interventions to address these learning gaps. This research will help teachers to easily identify the gaps in learning and enable them to support learners in constructing and improving the necessary knowledge to bridge the gaps.

5.6 Summary

Chapter 5 presented the conclusions and implications from the study. The key findings were discussed first, which began with the amount of time spent by learners before and during the COVID-19 pandemic on electronic devices. This was followed by a discussion about the levels of device usage by learners and how many Grade 2 learners (Grade 3 in 2022) fell into the minimum, average and high electronic device usage categories. The impact of the levels of electronic device usage on the social and cognitive development of the learners was first discussed separately and it confirmed the null hypothesis of the impact of the different levels of electronic device usage on the socio-cognitive development of learners. The research outputs and main contributions were presented next, which included how the research question was answered, which gaps in existing literature were addressed, how the study confirmed the relevance of Bandura's Social Cognitive Theory, and how these findings could be applied in the real world. The limitations and shortcomings of the study were discussed next, followed by recommendations for future research, based on the limitations and shortcomings. Chapter 5 concluded with a summary of the content presented in the chapter. The final section of this dissertation lists all the references used in the study.

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Appendix

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MASTER'S AND DOCTORAL DEGREE STUDENTS
NOTICE: SUBMISSION OF DISSERTATIONS AND THESES

Assessment of master's degree research dissertation or interrelated, publishable manuscripts/published articles and doctoral thesis or interrelated, publishable manuscripts/published articles.

A student who intends to submit their research in terms of a master's or doctoral degree for assessment must – on the prescribed form and with the approval of the supervisor/promoter and, if applicable, the co-supervisor(s)/co-promoter(s) – notify the official in the Postgraduate Office at Student Academic Services; or the Student Administration offices in the case of students in the Faculty of Health Sciences; or the Examination Administration Division: Student Academic Services, in consultation with the assistant dean and Campus Vice-Principal: Academic in the case of a student on the Qwaqwa Campus, of her/his intention to submit, as follows:

i. in the case of the Bloemfontein Campus, on or before the last working day in September of the preceding year in order to graduate during the April graduation ceremonies; or
ii. in the case of the Bloemfontein Campus, on or before the first working day in April to graduate during the December graduation ceremonies; or
iii. in the case of the Qwaqwa Campus, on or before the last working day in September of the preceding year to graduate during the May graduation ceremonies.

Please note: the general rules for master's and doctoral degrees applies in all circumstances. For full information, the rules can be found at https://www.ufs.ac.za/about-the-ufs/governance/policy-documents.

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Faculties on Bloemfontein Campus: • Economic and Management Sciences (except UFS Business School) • Education • The Humanities • Law • Natural and Agricultural Sciences • Theology and Religion	**All doctoral and master's degrees:** • Theses • Dissertations; or • Publishable manuscripts; or • Published articles	Email: DoctoralAdmin@ufs.ac.za **or** MastersAdmin@ufs.ac.za Office: Student Academic Services, First floor, George du Toit Building, Bloemfontein Campus

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Faculty of Economic and Management Sciences: UFS Business School	**All doctoral and master's degrees offered by the UFS Business School:** • Theses • Dissertations; or • Publishable manuscripts; or • Published articles	Evodia Tau (Doctoral) Tel: +27 51 401 3558 Taume1@ufs.ac.za Office: UFS Business School, Block B, Third floor, Economic and Management Sciences Building, Bloemfontein Campus Elvira Oberholzer(Masters) oberholzereh@ufs.ac.za Tel +27 51 401 3163 Office: UFS Business School, Block B 3rd Floor, Economic and Management Sciences Building, Bloemfontein Campus

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Dear Student
Once completed, the form must be submitted to your supervisor/promoter for approval.

STUDENT NUMBER:	2011010853	**TITLE:** Miss
SURNAME:	van Dyk	
FULL NAMES:	Danél	
QUALIFICATION TITLE: (e.g. Master of Arts)	Master of Education	
SPECIALISATION: (e.g. in English)	Early Childhood Care and Education	
PLAN CODE: (e.g. BC180022)	BC780081	**MODULE CODE:** (e.g. ENGM8900) EDCD8900
TITLE OF RESEARCH: (as approved by the faculty board)	The impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development	
ACADEMIC DEPARTMENT:	Education	
FACULTY:	Education	
POSTAL ADDRESS: (as on date of notice)	2B Tinktinkie Avenue, Cradock, Eastern Cape, 5880	
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Declaration:

I hereby declare that

1. I, in consultation and with the approval of my supervisor/promoter, give notice of my intention to submit a dissertation/ thesis or publishable article for examination with a view to the degree concerned being conferred at a graduation ceremony;
2. I have read and understand the rules pertaining to the assessment and requirements to be met in respect of the submission of my research as set out in the general rules of the UFS (uploaded on the UFS website at http://www.ufs.ac.za/about-the-ufs/governance/policy-documents) and/or the faculty rules (uploaded on the UFS website at http://www.ufs.ac.za/rule-books);
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Signature of **student**:  Date: **18/10/2022**

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GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

08-Dec-2021

Dear Ms Danél Van Dyk

Application Approved

Research Project Title:
The impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development

Ethical Clearance number:
UFS-HSD2021/1754/21

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

Dr Adri Du Plessis
Chairperson: General/Human Research Ethics Committee

Dr Adri du Plessis
Digitally signed by Dr Adri du Plessis
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The Impact of Electronic Devices During the COVID-19 Pandemic on Grade 2 Learners' Socio-Cognitive Development by Danél van Dyk 2011010853 A Thesis Proposal Submitted in Partial Fulfilment of the Requirement for the degree of Master of Education in EARLY CHILDHOOD CARE AND EDUCATION of the University of the Free State Bloemfontein, South Africa ********* 2021 _____ Dr. B. Ndlovu (Supervisor) i ACKNOWLEDGEMENTS First, I would like to thank Dr Blanche Ndlovu, lecturer and acting head of the Department of Childhood Education at the University of the Free State, for her encouragement, expertise, and guidance throughout the research process and completion of this dissertation. Thank you to Prof Okeke and Dr Ugwuanyi for their guidance and expertise in compiling Chapters 1 and 2 and for helping me through the Care and Treatment Review (CTR) process. Thank you to everyone who actively participated in the data collection process and did so with enthusiasm – your contributions were essential to this study. Thank you to Brenda and Hugo at Busy Bee Editing for your professionalism and hard work of editing and making my dissertation the best it could be – linguistically speaking! Thank you to the University of the Free State for my Postgraduate and Language Editing Bursaries. These bursaries enabled me to fulfil my dream of completing my Master's Degree in Education. Finally, I would like to thank my Mom, Dad, and Willem for their unconditional love and support throughout this whole process. It would not have been possible without you! ii DEDICATION To all of the learners, parents and teachers affected by the COVID-19 pandemic. iii ABSTRACT The COVID-19 pandemic has led to an increased usage of electronic devices by learners, due to virtual classrooms and devices used for entertainment, which may impact the socio-cognitive development of learners. Previous studies done mainly outside of South Africa show mixed results: Electronic devices are beneficial to a certain extent but have detrimental effects on learners' social behaviour and cognitive abilities. The impact of electronic devices on the socio-cognitive development of learners has not yet received adequate attention from researchers within South Africa. This study aims to explore the impact of electronic devices during COVID-19 on the socio-cognitive development of Grade 2 learners. The location of the research is in a preparatory school (Grades 1 to 3) in the Eastern Cape in South Africa. Methodologically the research used three questionnaires (screen time, social development, and cognitive development) participated in by parents, teachers and learners respectively, framed by the Albert Bandura's Social Cognitive Theory. The findings of the study showed that online learning and school closures severely impacted the socio-cognitive development of learners, and that they were not at the expected developmental level for their age group. Screen time increased significantly. However, the different levels of electronic device usage by learners had no significant impact on development. The COVID-19 pandemic, school closures, and online learning had a detrimental effect on the socio-cognitive development of the

learners. Intervention should be done to address the underdeveloped socio-cognitive skills of learners. Keywords: electronic devices, COVID-19 pandemic, National Lockdown, social development, cognitive development iv RESEARCH JOURNEY Writing this dissertation has been a journey of more than eighteen months. My research topic was picked quite easily – the COVID-19 pandemic quarantined teachers and learners at home and schooling was done online. I noted that the lockdown and online learning increased my own screen time and I wondered if the same was happening to learners. This inspired me to read more about the impact of electronic devices on the development of learners i.e. the social, cognitive, emotional, and physical development. The number of studies done on this topic overseas was astounding and I realised that I would have to narrow it down to social and cognitive development only. The proposal chapter, title registration and the literature review chapter were the most daunting part of the process, which took ten months to complete. By the time my methodology chapter and instruments were ready to be used in the data collection, the Grade 2 learners had progressed to Grade 3. This prompted me to adapt the instruments to include certain concepts taught in Grade 3, while the rest of the questions remained relevant to Grade 2's (eight-year-olds). The data collection process went smoothly and then it was time to analyse the data to see if the pandemic and increased screen time had impacted the socio-cognitive development of the learners. Before I knew it, I was busy writing study conclusions and recommendations for future research – some of which I am considering undertaking myself. This whole process has been an amazing journey with many challenges and triumphs – and in the end, it was all worth it! v LIST OF ACRONYMS Acronym Definition 3-D Three Dimensional Shapes AAP American Academy of Paediatrics ABC American broadcast network ACP The American College of Paediatricians ADHD Attention-deficit/hyperactivity disorder ANOVA Analysis of variance CAPS Curriculum and Assessment Policy Statement COVID-19 Severe acute respiratory syndrome coronavirus 2 CRY Child Rights and You DAK-Gesundheit Deutschen Angestellten-Krankenkasse DBE Department of Basic Education DVD Digital Video Disc ECE Early childhood education ICT Information and Communication Technology MP3 Moving Picture Experts Group Layer-3 Audio SARS-CoV-2 Severe acute respiratory syndrome coronavirus 2 SCT Social Cognitive Theory SEL Social and emotional learning TV Television UK United Kingdom UNICEF United Nations International Children's Emergency Fund US United States of America USA United States of America WHO World Health Organisation vi LIST OF TABLES AND FIGURES Table 1: Themes that emerged from the study.....80 Figure 1: Daily electronic device usage in hours.....85 Figure 2: Social development scores of participants as a percentage (%) out of 100 .....97 Figure 3: ANOVA test for social development.....97 Figure 4: Mathematical errors made in cognitive development test.....98 Figure 5: Cognitive development scores of participants as a percentage (%) out of 100 .....106 Figure 6: ANOVA test for cognitive development.....107 vii TABLE OF CONTENTS

Social development is a life-long process and determines how social situations are identified, interpreted and reacted to. Healthy social development is beneficial to protecting children's mental health and wellbeing. Daily contact with family, friends and educators teaches children about the social world. Through these connections, children figure out where they fit in and build identity (BeYou, 2018:1). Guidance and modelling in daily interactions and incidental opportunities, and planned lessons teach social skills to children (BeYou, 2018:2). Pathways (2021:1) pointed out that social skills are crucial for relating to others. These skills help children manage their emotions, build positive relationships, and demonstrate empathy. Children with functioning social skills are more likely to succeed academically (Pathways, 2021:2). Morin (2020:1) defines cognitive development as the ability to construct meaning and knowledge through experiences. Cognition enables us to consider new information, process it, and act on it. Cognition involves applying new information to previously acquired knowledge, higher level thinking, and skilful information processing (Morin, 2020:1). Cognitive development improves focusing ability, remembering and critical thinking. These skills benefit children inside and outside the classroom (Morin, 2020:2). Children actively participate in learning - they experiment, perceive and learn about their world (Cherry, 2020:1). Children's development is interwoven with technology, which has become more integrated into our lives (Moloney, 2020:1). Pinola (2021:11) states that our lives are becoming increasingly driven by technology. Electronic devices can help children learn in interactive ways, demonstrate creativity, and connect with others. At the same time concern is rising about the impact of screen time on healthy development of children who are bound to technology. An Erikson institute survey reported that 85 per cent of parents provide children under six with technological entertainment at home and 86 per cent stated that they found electronic devices to be beneficial for literacy development, school readiness and success (Pinola, 2021:11). Morin (2020:1) confirmed that growing up with a vast array of electronic devices provides endless hours of entertainment and educational content. Morin (2020:1) pointed out that electronic devices have negative effects on social behaviour, relationships, education, physical health, and sleep. Lee (2019:1) mentioned that screen time of learners averages 7.5 hours per day, which is linked to lower grades in school. Research was done on the use of electronic devices and its impact on development has shown mixed results. South African parents overstep screen time guidelines globally and nationally, allowing their children more than one hour of screen time daily. Children from urban high-income homes exceed the guidelines by 67 per cent, while those from low-income urban and rural settings exceed the guidelines by 26 and 3.5 per cent, respectively (Independent Online, 2021:1). Al Sagr and Al Sagr (2021:2,3) in Saudi Arabia suggested that children who mastered the use of electronic devices by primary school age ignore their surroundings, their behaviour is impacted and 3 psychological and cognitive issues arise such as anxiety, depression, attention deficits, learning problems, and language delays. Rocha and Nunes (2020:1) noted that screen time may scaffold reading, but for children younger than five the damage is greater than the benefits - mainly sleep disorders, concentration problems and lack of play. The Canadian Paediatric Society (2017:462) highlighted positive and negative effects. TV programmes that are designed well and have specific educational goals support early language and literacy development. They foster cognitive development through promoting positive racial attitudes and imaginative play. The negative effects include language delays, inattention, poor language use, lower cognitive abilities, short-term memory problems, and early reading difficulties (The Canadian Paediatric Society, 2017:462). Many other studies have been conducted with similarly mixed results. Recent studies have found that social and cognitive development is impacted by excessive usage of electronic devices. Beatty and Egan (2018:12) conducted a study in Ireland with parents of 9,000 five-year-olds and found that children who spend an exorbitant amount of time on educational games and watching TV scored significantly lower in their ability to reason. Children devoted to computer and video games had significantly lower scores in vocabulary development (Beatty & Egan 2018:12). Beatty and Egan (2020:1) found in a more recent study that children who were participated in various activities for three hours daily scored higher on reasoning ability than those who were only using electronic devices. Beatty and Egan also suggested that TV viewing can improve vocabulary development if the content is appropriate for the developmental level of the children and exposure is not prolonged. Kardefelt-Winther (2017:7) stated that digital technology can enhance social relationships and moderate use is beneficial for mental wellbeing, however excessive usage may have negative effects. Dore, Zosh, Hirsh-Pasek and Golinkoff (2017:80) found that screen time has a positive impact on language development by being interactive and responsive, such as in interactive reading applications. Researchers have recently been interested in the impact of electronic devices, since technology is integrated with our daily lives and those of children from a young age. More than 75 per cent of families own mobile devices and screen time and usage is rising (Lissak, 2018:149). In the United Kingdom (UK), 82 per cent of five to seven-year olds are online, 42 per cent own their own tablet and 97 per cent watch TV for an average of 13.5 hours per week (Burns & Gottschalk, 2019:2). The usage of electronic devices can be beneficial by supporting social interactions and developing cognitive reasoning and early reading and language skills; however, the detrimental effects cannot be ignored. The excessive use of these devices impacts all areas of childhood development, specifically social and cognitive development. Rocha and Nunes (2020:2) confirmed that screen time decreases time spent on important childhood activities, such as creative play and reading, and increased screen time corresponds with sleep disorders, concentration problems, and obesity. Studies have shown mixed results on how parents and teachers experience excessive electronic device usage. A study done in Canada found that parents believe that TV viewing has educational benefits and supports wellbeing (Archer, 2017:20). A study done in the USA highlighted that parent and child attachment interactions are critical to brain development, which impacts emotional processing and self-regulation. Electronic devices can interfere with these interactions - even background TV negatively impacts the quantity and quality of social interactions (Courtney & Nowakowski-Sims, 2018:12). Another US study found that 70 per cent of parents are concerned about their children spending too much time in front of screens and they were distressed about the possible impact of screen time on development. Parents are concerned about their children's interpersonal skills, healthy friendships, and school performance (Auxier, Anderson, Perrin & Turner, 2020:2). Not many studies have been done on teachers' experiences with excessive electronic device usage. One of the US studies suggested that the technological trend has impacted daily learning (Thomas, 2018:6). Over 90 per cent of Early Childhood Educators use computers in class to foster social interaction and as a teaching tool (Thomas, 2018:6). A study done in Australia by the Murdoch Children's Research Institute with eight and nine-year-olds revealed that too much screen time had a negative impact on learning abilities and produced lower reading performance (Blundell, 2020:1). Time spent on electronic devices since 2020 increased dramatically, due to the COVID-19 pandemic. Millions of learners were compelled to switch to online learning and time spent on social media skyrocketed according to studies done in the UK, US and Spain. Visits to websites and apps increased 100 per cent in January 2021, compared to the previous year, specifically on sites like TikTok and YouTube (Geddes S & Marsh, 2021:1). During the lockdown in the US, learners spent two to three hours in front of a screen for Zoom lessons and Google Classroom. The National Institute of Health study found that exceeding two hours of screen time per day led to learners scoring lower on language and thinking tests, as well as being less able to focus. Learners were also experiencing emotional meltdowns – as they lacked the social development to control emotions (D'Souza, 2020:1-2). The COVID-19 pandemic completely redefined the way our lives are lived and resulted in excessive electronic device usage by learners during 2020 and during the first school term of 2021. Most schools continued with split classes and online classes were still offered to learners at home. The rise in screen time during the COVID-19 pandemic will impact learners in the Foundation Phase greatly. At this time, the consequences are still murky and it may take years to understand the effects (Kelly, 2021:1). Previous studies have shown that excessive screen time causes language delays, attention problems, delayed language development, lower cognitive abilities, and decreased communication and interaction (Canadian Paediatric Society, 2017:462; Beatty & Egan 2018:12-13). Studies have been done worldwide regarding the increase in screen time during the COVID-19 pandemic. A Canadian study reported an increase of screen time in learners of 87 per cent, while in China 70 per cent of the 1,033 participants spent more time on electronic devices (Sultana, Tasnim, Bhattacharya, Hossain & Purohit, 2020:2). Studies conducted in the US by the National Institute of Health (D'Souza, 2020:1,2) highlighted the detrimental effects of increased screen time, and a study done by Dorn, Hancock, Sarakatsannis and Viruleg (2020:1) from consulting firm McKinsey & Company estimated that the shift to online learning set learners back by up to three months of learning. Statistics South Africa (2020:13) reported that 25 per cent of learners were not involved in home-schooling. The report also stated that children spent more time viewing television and browsing the internet during the lockdown. Despite the fact that this phenomenon has received huge attention among researchers across the globe it would appear that empirical evidence is lacking on the impact of electronic devices in the time of the COVID-19 pandemic on the social and cognitive development of learners within South Africa. A study regarding the impact of electronic devices in the time of the COVID-19 pandemic on the social and cognitive development of learners within South Africa, will provide insight into the consequences of excessive screen time usage. The study will provide information on the aftermath of the COVID-19 lockdown regarding social and cognitive developmental delays of learners and on how to address these issues to support the development and learning of learners. Against these backgrounds, it is, therefore, necessary to embark on the study of the impacts of electronic devices on the social and cognitive development of learners in the time of the COVID-19 pandemic. 1.3 Problem statement Previous studies worldwide have shown that excessive screen time has detrimental effects than benefits on children's development. Social development affects how social situations are recognised, interpreted and responded to, while cognitive development affects one's ability to gain meaning and knowledge from experience and information. Both of these developmental domains impact a child's success inside and outside the classroom. Excessive electronic device usage is linked to lower cognitive abilities, learning problems and social interaction and language development issues. COVID- 19 has also increased media exposure, due to online teaching and increased time spent on electronic devices. South African researchers have yet to conduct studies on the impact of electronic devices in the time of the COVID-19 pandemic on the socio- cognitive development of learners. Thus, this study intends to determine the impacts of electronic devices in the time of the COVID-19 pandemic on the socio-cognitive development of Grade 2 learners of 2021 in South Africa. These learners were in Grade 1 during 2020 and the National Lockdown, which is a crucial time for Foundation Phase learners, where all the fundamental skills are being developed for future learning. This study will determine the amount of time learners normally spend on electronic devices and how much time was spent on electronic devices during the COVID-19 pandemic, after which the impact of electronic device usage on the socio- cognitive development of Grade 2 learners of 2021 will be examined. 1.4 Rationale for the study Studies worldwide have been done on screen time and its effect on development. Many studies on this topic were done internationally. This study focuses on the South African context, bearing in mind that our cultural and ethnic diversity differs greatly from that of America or other countries in which such studies have been conducted. 7 South African researchers have not studied the impact of electronic devices during the COVID-19 pandemic on the socio-cognitive development of learners. COVID-19 impacted schools and teaching greatly – teaching methods had to be adapted to offer online classes to children. Teachers reported a variety of issues when learners returned to school: they fell behind with their work. Some learners did not complete any online work and had little motivation to return to school. This study is necessary because it promises to provide empirical evidence on how the perceived increased use of electronic devices among learners during the COVID-19 pandemic may be affecting the wellbeing of learners. This study aims to determine the impacts of electronic devices during the COVID-19 pandemic on Grade 2 (2021) learners' socio- cognitive development - who are now in Grade 3. 1.5 Aim of the study This study aims to explore the impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development. 1.5.1 Specific objectives 1.5.1.1 To determine the amount of time that Grade 2 learners normally spend on electronic devices. 1.5.1.2 To determine the amount of time that Grade 2 learners spent on these devices during the COVID-19 pandemic. 1.5.1.3 To categorise learners into different levels of electronic device usage (minimal usage = 1 to 2 hours per day, average usage = 3 to 5 hours per day, high usage = 6+ hours per day). 1.5.1.4 To assess the impact of different levels of

electronic device usage on the social development of learners. 1.5.1.5 To assess the impact of different electronic device usage levels on learners' cognitive development. 1.6 The Main research question What is the impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development? 1.6.1 Sub-research questions 1.6.1.1 What is the amount of time that Grade 2 learners normally spend on electronic devices? 1.6.1.2 What is the amount of time that Grade 2 learners spent on electronic devices during the COVID-19 pandemic? 1.6.1.3 What are the levels of usage of electronic devices by learners during the COVID-19 pandemic? 1.6.1.4 What is the impact of different levels of electronic devices used on the social development of learners? 1.6.1.5 What is the impact of different levels of electronic devices used on the cognitive development of learners? 1.6.2 Hypotheses Electronic device usage during the COVID-19 pandemic and how it significantly impacts the socio-cognitive development of Grade 2 learners. 1.6.2.1 There is no significant difference in the amount of time learners spent normally on electronic devices and the amount of time spent on them during the COVID- 19 pandemic. 1.6.2.2 There is no significant difference in the levels of usage of electronic devices by learners during the COVID-19 pandemic. 1.6.2.3 There is no significant impact of different levels of electronic devices used on the social development of learners. 1.6.2.4 There is no significant impact of different levels of electronic devices used on the cognitive development of learners. 1.7 Scope of the study This study focuses on the impacts of electronic devices usage on South African learners in Grade 2 in 2021, who were in Grade 1 during the COVID-19 National Lockdown of 2020. These learners have since progressed to Grade 3 and the study was adapted accordingly. The study was done in a rural town in the Eastern Cape in South Africa. It is a preparatory school, which only includes Grades 1 to 3. It is a double medium school (Afrikaans and English). Learners come from culturally and ethnically diverse households. Parents were invited to complete a questionnaire regarding the 9 normal electronic device usage of their children and the amount of time spent on electronic devices during the COVID-19 pandemic. Learners are then categorised as minimal usage, average usage, or high usage of electronic devices, after which they completed a mathematics achievement test (cognitive development) and their teachers completed a Social Development Questionnaire regarding the learners individually. 1.8 Significance of the study The use of electronic devices impacts the social and cognitive development of learners. During the National Lockdown of 2020 and the ongoing pandemic, the amount of time spent using these devices increased. Previous studies have focused on the benefits and negative effects of using electronic devices. This study determined the impacts of electronic device usage during the COVID-19 pandemic. The findings of this study will benefit learners, parents, and early childhood educators. The findings will inform parents and early childhood educators about the social and cognitive developmental delays caused by electronic device usage. The findings will also enable parents and early childhood educators to address these delays, promote healthy childhood development and limit daily electronic device usage. The findings will also inform the Department of Basic Education (DBE) on the developmental impact of electronic device usage during the COVID-19 pandemic and enable them to address the developmental delays for effective intervention and teaching. 1.9 Definition of operational concepts Electronic devices: Electronic devices refer to televisions, computers, electronic games on gaming consoles (Xbox or PlayStation), and hand-held devices such as cell phones and tablets. Screen time is also used to refer to time spent on electronic devices. COVID-19 pandemic: An ongoing global pandemic of the coronavirus disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was first identified in China in December 2019. National Lockdown: The time during which the COVID-19 pandemic was at its worst in South Africa in 2020, which led to the National Lockdown from 26 March to 20 July 2020. 10 Social development: The process by which children learn to interact with family, peers, teachers, and others around them and the skills required to communicate with others and process their actions. Cognitive development: The development of knowledge, skills, problem-solving, and reasoning which enables children to think about and understand the world around them. 1.10 Preliminary literature review 1.10.1 Introduction The impacts of electronic devices on the social and cognitive development of learners during the COVID-19 pandemic is a relatively new topic in academic discourse. The impacts of electronic devices on childhood development have been a topic of interest for many researchers worldwide, but literature on the impacts of increased electronic device usage during the COVID-19 pandemic is scarce. The lack of empirical knowledge poses a challenge in expanding the body of knowledge regarding the impacts of increased usage of electronic devices on the social and cognitive development of learners who were in Grade 1 during the National Lockdown in South Africa. The first section of this literature review explores the conceptual framework of the study. The next section discusses the COVID-19 pandemic, followed by the various types of electronic devices. The social development of learners is presented next, followed by the cognitive development of learners. Albert Bandura's Social Cognitive Theory is discussed as a theoretical framework for the study. A review of the related empirical studies follows. The following sections explore studies on the usage of electronic devices during the COVID-19 pandemic; the impact of different levels of electronic device usage on the social development of learners; and the impact of different levels of electronic device usage on the cognitive development of learners. The literature review concludes with a summary. 1.10.2 Conceptual framework 1.10.2.1 The Coronavirus (COVID-19) pandemic The current COVID-19 pandemic arose from the coronavirus SARS-CoV-2. This virus causes respiratory diseases in humans, which range from the common cold to more rare and serious cases with high mortality rates (WHO, 2020:1). The World Health Organisation (WHO) announced a number of pneumonia cases in Wuhan City, China on 31 December 2019. SARS-CoV-2 was confirmed as the causative agent, which is an infectious disease spread directly and indirectly from one person to another through close contact, droplets, and contaminated objects (Government of South Africa, 2020:2). The virus spread worldwide at an alarming pace and featured a high mortality and morbidity rate. WHO declared COVID-19 a global pandemic on 11 March 2020 (Nyashanu, Simbanegavi & Gibson, 2020:1443). South Africa acted swiftly and severely after the WHO's declaration to curb the spread of the virus and declared a National Lockdown effective as of 26 March 2020 (Government of South Africa, 2020:4; Spaull & van der Berg, 2020:1). The lockdown started as a three week period, which morphed into eight weeks of strict quarantine. Schools and crèches were closed during this period, temporarily reopened for Grades 7 and 12 and subsequently closed again (Spaull & van der Berg, 2020:1). The lockdown officially ended in August 2020 and Foundation Phase learning (Grades 1 to 3) opened on 24 August 2020 after being closed for five months (Government of South Africa, 2020:4). 1.10.2.2 Electronic devices and types Electronic devices are used daily, such as a smartphone which is checked constantly, with a camera; accompanying us on travels and television which enables us to binge- watch our favourite shows (Eadicicco, Peckham, Fitzpatrick, Pullen, Luckerson & Howorth, 2016:1). These devices form an important part of our day-to-day life and simplify our daily work. The National Council of Education and Training (2020:1) classifies these devices as consumer electronics, which are made for everyday use. Consumer electronics are further categorised as office gadgets like personal computers, projectors and printers; home appliances like refrigerators and washing machines; audio and video systems such as DVD players, TVs, and video game consoles; advanced consumer devices like smartphones and tablets; and storage devices such as MP3 players. Smartphones are defined as cellphones and cater for more than sending text messages and making phone calls (Computer Hope, 2021:1). Smartphones can be used to browse the internet and run software applications like a computer. Touchscreen technology is used to interact with software and thousands of applications are available for use, including games, and personal and business applications. Smartphones enable users to take, show and store pictures and video, as well as record and play audio and music (Computer Hope, 2021:1). Computers are electronic devices that manipulate data and information (Goodwill Community Foundation Global, 2019:1). They can store, retrieve and process information. They enable users to type documents, send emails, browse the web and play games. Users can create or edit presentations, videos, and spreadsheets on computers. A personal computer can refer to a desktop computer that is placed on a desk and is stationary, or a laptop that is battery powered, more portable and can be used almost anywhere (Goodwill Community Foundation Global, 2019:3). Tablets are highly portable personal computers of which the primary interface is a touchscreen (Lenovo, 2019:1). The touchscreen fills the length and width of the device and the speaker and microphone are optimised for hands-free calling. Tablets blend the best features of smartphones and laptop PCs, thereby creating a grand mobile computing experience. Tablets enable users to browse the web, play interactive games, and use an array of applications for work and entertainment (Lenovo, 2019:1). Televisions (TVs) are defined as box-shaped devices that receive electrical signals and convert them into moving images and sound (Cambridge Dictionary, 2021:1). Smart TVs are a succession of a computer and a regular TV, which integrates internet and web features. They enable users to view content on apps, browse the internet, and stream music and videos (Donovan, 2021:3). Streaming services like Netflix and Hulu are very popular among users and they can also watch classic programmes, movies, and children's shows on a Smart TV. Smart TV also enables users to play games with or without a gaming console (Bates, 2018:1,2,5). Video gaming consoles are gaming boxes or devices that are primarily designed to play games on a TV. Examples of gaming consoles include Microsoft Xbox, Sony PlayStation, and Wii (Computer Hope, 2020:1). Gaming consoles allow for shared gaming experiences through co-op gaming, as well as online gaming. Gaming consoles can also be used as a media centre for regular TVs, by enabling users to access streaming services such as Netflix, Hulu, YouTube, and Spotify. These consoles can play Blu-Ray discs and USB files (Brookes, 2020:1). 1.10.2.3 The social development of the learner Early childhood social development is crucial to overall health and wellbeing throughout life. It is linked closely to cognitive and emotional development, forming the foundation for developing relationships and enduring stressful situations (Reflection Sciences, 2017:1). Social development is the emerging ability to form secure peer and adult relationships, articulate and manage emotions in socially and culturally appropriate ways, and learn from exploring the environment. This all happens in the context of culture, family, and the community. Social development facilitates perspective taking, emotional control, and self-confidence (Darling-Churchill & Lippman, 2016:1). Social competency is increasingly recognised as a key factor for children's success in school and other settings later in life. Social experiences with primary caregivers and interacting with other children and adults at a young age influence prospective academic and personal outcomes and fortify other areas of childhood development (Darling-Churchill & Lippman, 2016:2). Social and emotional skills are crucial for school readiness and executive function skills play an essential role in development, enabling learners to focus in class, shift between activities, and cooperate with others. The executive function directs all cognitive skills, which helps people control behaviour, develop relationships and accomplish tasks (Reflection Sciences, 2017:2). By the age of five, children are aware of their individualism and can develop friendships with peers. They can understand thoughts and feelings and initiate or join in play with peers and create their own games (Reflection Sciences, 2017:2). Malik and Marwaha (2020:2) confirmed that by the ages of five and six, children spend more time in peer groups and identify with friends. Their imaginary play is more elaborate and they act out fantasies. By the ages of seven to eight, children develop a deeper understanding of relationships and responsibilities, while moral development progresses and coping skills become more complex. Darling-Churchill and Lippman (2016:2) declared that maladjustment in the social development domain can impede the ability to function in a school, family, or other contexts. If children fail to establish secure attachments, they will experience difficulties later on with conveying or controlling emotions and may be unable to develop healthy relationships with peers (Darling-Churchill & Lippman, 2016:2). 1.10.2.4 Cognitive development of the learner Cognitive development is all about learning and is influenced by genes and experiences. Cognitive development is the workings of the mind, how children think, perceive their world and implement what they learn (Virtual Lab School, 2019:1). During the initial years of a child's life, substantial brain development takes place that is crucial to cognitive development. Between the ages three to five, accellerated growth occurs in various cognitive domains, including language processing and higher-order cognition processes, which are executive functions. Executive functions enable us to hold things in our minds and suppresses prepotent behavioural tendencies. Executive functions and cognitive ability in early childhood predicts various fundamental life outcomes, such as mental health, academic achievement, and work success (Verswijveren, Wiebe, Rahman, Kuzik & Carson 2020:1,2). Increasingly competent executive functions of childhood empower children to operate in ways that make them successful students and friends to peers (Centre on the Developing Child at Harvard University,

2020:4). These first few years are also critical to overall development, since the brain's ability to adapt reduces with age (Wright, 2017:1). Cognitive skills include logic and reasoning, memory and working memory, attention, flexibility and adaptability, and exploration of cause and effect (Wright, 2017:2). During the preschool years, amazing changes occur in thinking skills. Children use their imagination to play and learn. They can compare, contrast, organise and analyse information and develop more complex ways to solve problems. Their mathematical and scientific thinking also becomes more sophisticated. It is important to note that thinking skills develop in a predictable sequence, but every child's development is unique (Virtual Lab School, 2019:2). Opportunities to maximise cognitive development in early childhood should be identified to ensure optimal health and wellbeing later in life (Verswijveren, et al., 2020:2). 1.10.3 Theoretical framework – The Social Cognitive Theory of Albert Bandura The Social Cognitive Theory (SCT) is a psychological perspective on human behaviour, which emphasises the crucial role of the social environment on motivation, learning, and self-regulation (Schunk & DiBenedetto, 2020:1). This theory emphasises the importance of observational learning, which occurs when individuals observe a model, remember what the model did, are able to repeat the observed behaviour and have the motivation to do so. The motivation for the performance of modelled actions depends greatly on positive consequences. These expected outcomes are cognitive ideologies, which are refined through social interactions between observers and models (Schunk & DiBenedetto, 2020:1). Fundamentally, this theory accentuates the mutual relationship and interaction between characteristics of the individual, conduct and the environment. Individuals have an agentic, active role in facilitating learning and creativity (Rubenstein, Ridgley, Callan, Karami & Ehlinger, 2018:101). Individuals seek this sense of agency, which is the ideology that they have a considerable degree of influence on momentous events in their lives. Individuals use self-regulative and cognitive capabilities to set goals and implement strategies to achieve them (Schunk & DiBenedetto, 2020:2). Ayre and Krishnamoorthy (2020:270) pointed out that behaviour is about socialisation and the reciprocal influence of other people's behaviour on ours. The key element is shared experiences with others and the moulding of children's conduct through modelling of the desired behaviour and the reproduction thereof. Therefore, the key elements of the SCT are modelling, observing and copying the behaviour. The key components for successful modelling are attention, retention, motor reproduction and motivation (Ayre & Krishnamoorthy, 2020:271). Albert Bandura's Social Cognitive Theory is a fitting framework for the intended study, as it emphasises both the social and cognitive development of children and highlights the close link between social and cognitive development. The SCT proposes an intentional active role of individuals in generating outcomes and highlights the importance of the educational environment and modelling process (Rubenstein et al., 2018:101). This theory is grounded in social observational learning and cognitive processing, which then leads to produced behaviour supported by cognitive beliefs and positive consequences (Schunk & DiBenedetto, 2020:1). The SCT can be applied to determine how electronic media and content affect children's social behaviour, on the basis that children learn in the context of social relationships (Kara, 2018:102). This theory is therefore applicable because children copy the modelled behaviour of parents and peers regarding the usage of electronic devices. This study will explore observational learning regarding electronic device usage and the impacts thereof on the social and cognitive development of learners, due to a lack of social interaction with peers and other adults during the ongoing COVID-19 pandemic. Recent studies have applied the SCT with success. Rubenstein et al. (2018:100) conducted a mixed-method study on teachers' perceptions of creativity by applying the SCT factors of personal characteristics, behaviour and environment, to determine how they facilitate learning and creativity. The focus was on the role of the teacher and their perceptions and characteristics and how teachers' sense of agency led them to act intentionally and influence learner creativity (Rubenstein, et al., 2018:101). Rubenstein et al. (2018:107) achieved success with the application of SCT and discovered that the teachers and their beliefs are uniquely situated in an interactive, reciprocal and agentic context depictive of classroom roles. A case study was done by Kara (2018:100) on the Screen-Free Week Project. Voluntary families participated in reducing screen time for a week. The study highlighted the importance of family-child interaction, watching programmes and playing games with children. Families set a suitable time limit for screen time that was appropriate for the developmental level of children. The project was successful and aims to become more widespread in the future. Alsadah (2017:3) conducted a qualitative study on the use of electronic media and its impact on the social development of children and parental views on media usage. SCT was applied based on its principles of communication, imitation, observation and modelling. Alsadah (2017:36-37) proved that children are unable to properly develop social skills when not becoming involved in real life situations. Parents who confirmed heavy device usage by children claimed that device usage is an essential skill, but some of their children struggle to communicate and express their feelings. 1.10.4 Review of related empirical studies 1.10.4.1 Usage of electronic devices by the learners during the COVID-19 pandemic The COVID-19 pandemic impacted general health and child development through the sanctioned or mandated social confinement in a pursuit to slow the spread of COVID- 19. This led to reduced social interaction, the shutdown of schools and excessive electronic device usage (Araújo et al., 2020:2). A cross-sectional study done by Araújo et al. (2020:3) with results from China, England, Nigeria and South Africa, suggested that the restrictive social reconfigurations and isolated family life interfered negatively with the structuring of children's brain architecture. The study reported that for parents and children, the balance of daily activities is transformed during social isolation and these adjustment from children's development from embracing its full potential (Araújo, et al., 2020:3). Montag and Elhai (2020:1) reported that during the global lockdown approximately 1.5 billion learners were staying at home by the end of April 2020. During this period the youth were more susceptible to spending immoderate time on electronic devices. DAK-Gesundheit (2020:9), a health insurance company in Germany, conducted a study with ten to seventeen-year-old children who reported playing video games weekly, which revealed that the children played about 138.6 minutes of video games on a work day one month after lockdown commencement, compared to 79.2 minutes in September 2019. An ABC news article in the USA by Pearle, Schwartz-Lavares, Roy and Yang (2021:1) reported that screen time appears to be moving towards all the time and our brains are becoming more addicted to screens, with the youth being most susceptible. Our brains are biologically wired to continue watching, which releases dopamine (feeling of pleasure) and reinforces the behaviour of doing more of what we love. Johnson (2021:1) stated that by June 2020, 62 per cent of US parents to children aged fourteen to seventeen reported upwards of four hours daily spent on electronic devices by their children since the beginning of the COVID-19 pandemic. The pandemic produced an overall rise in the use of electronic devices among American children under thirteen and teens, with screen time now doubled across all ages. Johnson (2021:1) also mentioned that 44 per cent of five to ten-year-olds are spending upwards of four hours daily on electronic devices, whereas only 17 per cent had spent four hours per day on these devices prior to the pandemic. Eyimaya and Irmak (2021:26) conducted a study in Turkey and found that 71.7 per cent of children between six to thirteen-years old's device usage increased to a daily average of 6.42 hours per day. Parents Together Foundation (2020:1) confirmed that daily device usage had increased from three to six hours per day since the onset of the pandemic, which is a 500 per cent increase from before the crisis. Carrol, Sadowski, Laila, Hruska, Nixon and Haines (2020:1) reported that Canadian families saw an increase in electronic device usage during the COVID-19 pandemic of 87 per cent. Eyimaya and Irmak (2021:27) concluded that increased screen time was becoming a significant problem during the mass quarantine and children were spending the better part of their free time on screens after online classes. It would appear that empirical evidence regarding the excessive electronic device usage of South African children is lacking and needs to be investigated. 1.10.4.2 Impact of different levels of electronic device usage on the social development of learners Numerous studies reveal that the more time children spend on electronic devices, the worse their social and emotional development becomes (Pearle, et al., 2021:2). Excessive screen time is linked to a undoing of social skills, behavioural issues, irregular sleep patterns and violence. Learners went from interacting with peers and teachers at school and on the playground every day, to pure isolation at home during the pandemic (Pearle, et al., 2021:3). Tung (2016:14) explored the prevalence of screen viewing of children under two-years old in Singapore and classified the results under regular (any daily viewing) and heavy (two or more hours of daily viewing). Children engaged in more than two hours per day of TV or computer usage were more likely to develop emotional, social and aggressive behavioural problems (Tung, 2016:24). Tung (2016:26-27) also pointed out that more time spent on computers, TV and video games led to a lower sense of self-worth, self-esteem and depression and that higher levels of device usage led to emotional distress and anxiety. Kaur, Gupta, Malhi and Grover (2019:786) conducted a literature review on the burden of screen time and found that electronic device usage led to decreased communication between parents and learners and increased the likelihood of disagreements when parents' attention was engaged elsewhere. Children attempt to simulate screen time habits and programmes watched on screens. The literature suggests that aggressive and antisocial behaviour is linked to extended screen time, due to the absence of positive role models and unselective media content viewing. Kaur et al. (2019:786) also established that the later consequences of excessive screen time surfaced later at school going age and the developmental path of children who were exposed to exorbitant hours screen time may lead to unhealthy adolescence. Learners may also be less likely to engage with peers and teachers in school and be prone to victimisation. Beatty and Egan (2020:6) confirmed that various screen activities and high levels of TV watching have an effect on social skills, which contribute to poorer social development. 1.10.4.3 Impact of different electronic device usage levels on learners' cognitive development Studies have shown that children who are occupied with electronic devices for a significant amount of time per day are experiencing more risks to cognitive development than ever before (Cochran, 2018:8). Cochran (2018:9) reports that children who are subjected to exorbitant hours of screen time too soon show impeded focus, concentration and attention, and are less able to sense other people's attitudes and communicate with them. Too much screen time also hampers expansive vocabulary building. Tung (2016:24) mentioned that more than two hours of device usage per day led to attention problems later in life. Each hour of TV watched daily at the age of three increased the chances of attention problems by the age of seven by 10 per cent. Tung (2016:27) reported that a study done by the Californian Department of Education on 500,000 learners found that irrespective of a child's economic background, study behaviour and IQ, more time occupied with TV watching was directly equivalent to lower test scores. Al Sagr and Al Sagr (2020:5) conducted a study in Saudi Arabia and found that excessive TV watching, or electronic device usage was likely to impact the acquisition of expressive language. Early exposure to electronic devices contributed to cognitive delays and an increased risk of developing learning abilities later in life (Al Sagr & Al Sagr, 2020:6). Children younger than two exhibited delayed language acquisition, a short attention span and hyperactivity when exposed to electronic devices for upwards of three hours daily. Gottschalk (2019:13) confirmed that TV viewing for extended periods during childhood contributes to attention deficits in adolescence and found that one more hour of TV at the age of one is akin to a 28 per cent increase in the prospect of attentional problems at age seven. Gottschalk (2019:13) suggested that modest levels of TV viewing may not be detrimental, even for younger children. However, McHarg, Ribner, Devine and Hughes (2020:5) reported that elevated screen time corresponded with worse executive functioning and that it replaced activities that are crucial to cognitive development, such as manipulatives and imaginary play. As a result, cognitive development may be permanently negatively impacted which may cause detrimental effects on academic achievement (McHarg, et al., 2020:6). 1.10.5 Summary of preliminary literature review This literature review firstly looked at the conceptual framework for the study, focusing on the COVID-19 pandemic and the South African National Lockdown which was decreed to attempt slowing the spread of the virus. Various types of electronic devices were discussed; namely smartphones, personal computers, tablets and video gaming consoles. This was followed by a description of the social and cognitive development of learners and why they are essential to overall childhood development. Bandera's SCT theory was discussed as the theoretical framework for this study. The theory emphasises the link between social and cognitive learning, which will be applied in this study on the basis that observational learning plays an important role in development; which learners were deprived of during the National Lockdown and social isolation. Finally, a review of related empirical studies was done on the usage of electronic devices by learners during the COVID-19 pandemic, followed by the impact of different levels of electronic device usage on

both social and cognitive development with relevant studies conducted worldwide. 1.11 Research methodology 1.11.1 Introduction This section covers the research methodology that will be implemented in the study. Firstly, the research paradigm will be explained, followed by the research approach. Then the study design will be described, followed by the study site. Population, sample size, sampling procedures, and selection of participants will be described as well. Thereafter, the instruments for data collection, measurement of the validity, reliability, and piloting of the instrument, and the data collection and analysis procedures will be discussed. 1.11.2 Research paradigm The research paradigm pertaining to this study is the scientific research paradigm. This paradigm is a broad structure that encompasses viewpoints, beliefs, and an awareness of various theories and practices employed during scientific research 21 (Zukauskas, Vveinhardt & Andriukaitienė, 2018:123). This paradigm is a precise procedure with several stages. The researcher establishes a relationship between the research aims and questions. This paradigm depends on various factors, including the individual's mentality, view of the world, and various perceptions, beliefs, and attitudes that are connected to the perception of reality. The researcher's beliefs and values are key to this concept, in order to provide sound arguments and terminology for obtaining reliable results. The scientific research paradigm can therefore be described as the approach used in the research, the accomplishing process, and the method of implementation (Zukauskas et al., 2018:124). 1.11.3 Research approach The study used a quantitative research approach. A researcher identifies a research problem based on trends in the field or explains why something occurs. The research problem can be answered effectively by a study in which the researcher wants to determine the overall tendency of responses from individuals and then notes how varied this tendency is among people (Leavy, 2017:92). Quantitative research centres around breadth, statistical descriptions, and generalisability, objectivity, control and precise measurement. Quantitative approaches rely methodologically on deductive designs which build evidence in favour of specific theories and hypotheses (Leavy 2017:87). Quantitative data, such as the time learners spend on electronic devices, yields numbers that can be statistically analysed and used to describe trends about a large number of people (Leavy, 2017:92). 1.11.4 Design of the study An ex-post facto design will be implemented in this study. This design is used to explore possible causal relationships among variables that the researcher cannot control. The researcher designs the study to compare two or more samples that can be compared, except for a specified factor that occurred in the past (Akinlua, 2020:7). The possible causes are studied after they have occurred. Rather than controlling what will happen to subjects, the research focuses on what has occurred differently for comparable subject groups, and then explores whether the subjects in each group differ in some way (Akinlua, 2020:7). 1.11.5 Study site The study site for the research was a preparatory school in Cradock, a rural town in the Chris Hani District of the Eastern Cape in South Africa. Cradock consists of the suburbs of Cradock, Lingelihle and Michausdal (Cradock-info, 2021:2; Municipalities, 2016:1). The population of the town was 70,493 in 2016 and is culturally and ethnically diverse, including different races; namely Caucasian, Black, Coloured, and Indian (Municipalities, 2016:1). The school reflects the population of the town. The learners reside in town and in the surrounding suburbs. The school advocates the usage of electronic devices for teaching, including laptops, projectors, visualisers, and interactive whiteboards in all of the classrooms. 1.11.6 Population, sample size, and sampling procedures The key population for the study, the Grade 2 learners, have progressed to Grade 3 since 2021 and the study was adapted to the developmental level of Grade 3 learners. The study population incorporated the parents of the Grade 3 learners, the Grade 3 learners and their teachers at the school. Their children were in Grade 1 during the National Lockdown of 2020 and their learning was seriously impacted by online teaching and a lack of face-to-face classroom time. The learners' parents participated in the study, to give insight into the electronic device usage of these learners at home. The Grade 3 teachers were able to answer the Social Development Questionnaire about the learners since they had been working closely with the learners and had observed their social interactions. The teachers were able to answer the questions honestly, without worrying about the social desirability of answers, whereas parents may have answered the questions about their children's social development in a manner that they deemed socially desirable. There are 108 Grade 3 learners at the school who were invited to complete the first data collection instrument, after which a sample of ten Grade 3 learners per category, their teachers, and their parents were invited to participate in the rest of the study. A purposive sampling technique was used to select the participants who were representative of the study's target population. This sampling method seeks out information rich cases for the study, which will be able to address the research questions (Leavy, 2017:79). In this case, the population of the four Grade 3 classes is representative of the population of the town, which makes the results more generalisable. The parents and teachers of these children are also considered information rich. 1.11.7 Instruments for data collection First, all data was collected using Google Form Questionnaires. Survey research is popular in education for its adaptability, efficiency, and generalizability (Leavy, 2017:269). The first questionnaire focused on the amount of time learners spend on electronic devices before and during the COVID-19 pandemic. The questionnaire link was sent to all Grade 3 parents on the class WhatsApp group, inviting parents to participate in the study. Parents had a week to complete the questionnaire. Second, a Social Development Questionnaire was sent to the teachers to complete after learners had been categorised into levels of usage (i.e., ten learners per group). The levels of usage are minimal usage (one to two hours per day), average usage (three to five hours per day) and high usage (6+ hours per day). They had two weeks to complete the questionnaire. Last, an achievement test was conducted at about the same time. The achievement test was printed out for the learners to complete, after which the researcher recorded their answers on the Google Form. Achievement tests have a more restricted coverage than aptitude tests, they measure more recent learning and are closely tied to school subjects (Frey, 2018:1). The recipients completed the test in groups of ten, scheduled after school in a classroom. 1.11.8 Measures of instruments' validity and reliability and piloting Face validity determines if the instruments are measuring what they are supposed to measure (Leavy, 2017:114). Thus, the instruments were face validated by two experts in Early Childhood Education (ECE) and Care. The experts were requested to look at the instruments in terms of the appropriateness of the items to the research aims, the language of the instruments as well as the ability level of the mathematics achievement test. The comments of the experts were used to modify the instruments accordingly. After the validation, the modified instruments were subjected to pilot testing on three learners, their parents, and their teachers. The data to be obtained using the survey questionnaires was subjected to Cronbach Alpha reliability estimates to get the internal consistency reliability indices of the questionnaires. Their reliability indices were estimated accordingly. On the other hand, the data to be obtained using the mathematics achievement test was subjected to the Kuder-Richardson formula twenty reliability estimate to determine the reliability of the test. 1.11.9 Data collection procedure First, a letter was sent to the principal of Cradock Preparatory School to inform the school of the intended study and to ask permission to use the school as a conduit between the parents and the researcher. Second, the Grade 3 teachers were asked to send the link to the Google Forms Questionnaire to the parents of these learners. Both the letter to the principal and the questionnaire bore the contact details of the researcher and relevant information regarding the study. The data was then collected via a Google Form Questionnaire that was completed by the Grade 3 parents. The purpose of the questionnaire was to determine the number of time learners spent on electronic devices before the COVID-19 pandemic and the amount of time spent during the pandemic. The questionnaire link was sent to all Grade 3 parents on the class WhatsApp group, inviting parents to participate in the study. Parents were given a week to complete the questionnaire. The Social Development Questionnaire was sent to the teachers to complete when the learners had been categorised into levels of usage, ten learners per group. They were given two weeks to complete the questionnaire. The achievement test was conducted at about the same time. The achievement test will be printed out for learners and they can complete it, after which the researcher will record their answers on the Google Form. They completed the test in groups of ten, scheduled after school and in a classroom at school. The date and time were scheduled with parents and teachers beforehand. 1.11.10 Data analysis procedure The quantitative data was collected using online Google Form Questionnaires, of which the responses were converted to Google Sheets. Descriptive statistics were used to detail and summarise data in order to answer the research questions, while inferential statistics were used to test the hypotheses (Leavy, 2017:111-112). The data was specifically analysed using frequency, percentage and mean to answer the research questions while the hypotheses was tested at a 0.05 level of significance using analysis of variance. Once the analysis had been concluded, the results of the descriptive and inferential analysis were represented visually (Leavy, 2017:112). 1.12 Ethical considerations 1.12.1 Gaining entry Gatekeepers for the research project were contacted and asked for permission and consent to perform the study (Leavy, 2017:135). The gatekeepers for this project are the school governing body, principal, teachers, and parents. The gatekeepers were informed of the aims of the study and all relevant information. The study was conducted with respect to all gatekeepers. Learners completed the achievement test after school, which did not interfere with learning time. 1.12.2 Participants' right Participants have a right to ask questions and participation is voluntary (Leavy, 2017:157). Parents gave their consent for their children to participate in the study. If a learner was unwilling to complete the achievement test for the study, he or she could refuse to participate. Consent was checked on continuously - a learner, teacher or parent was allowed to change his or her mind. An opt-out letter was sent to parents, which they only completed and sent back if they did not want their child to participate. This also gave learners an opportunity to decide if he or she wanted to participate. 1.12.3 Informed consent Consent was informed. The study aims and methods were explained to the principal, the school governing body, teachers, parents, and learners. Parents and teachers completed a consent form with all of the relevant information regarding the study and their roles in it. Parents also filled in a consent form regarding their children's participation. The consent form also informed participants about the potential discomforts and benefits of participating. The research was also explained to the learners in a manner that they understood, through a PowerPoint Presentation. The researcher explained the benefits of the intended research to the target population and made it clear that they were in no manner being exploited (Leavy, 2017:157). 1.12.4 Obtaining consent Parents were informed about all aspects of the study and asked to give consent for their children to participate in the study. Leavy (2017:36) pointed out that if parents or legal guardians give their consent, learners may be asked to assent to a study. This means that they agree to participate after knowing about the study and any potential for risk or harm. Assent is obtained when minors are old enough to understand that they are volunteering to participate and may choose to refuse participation without penalty (Leavy, 2017:36). Parents and learners were required to complete the informed assent form if they chose to participate in the study. 1.12.5 Confidentiality All responses given via the questionnaires were confidential. No visual data was collected. The data collected and an undertaking was made that the participants of the study would not be discussed with anyone not involved in the study. Numbers were assigned to learners to ensure that they could not be linked to participants after the study had been completed (Leavy, 2017:117). 1.12.6 Protection from harm Participants can cause distress if not managed properly. In the study, If a parent did not want a child to participate, he/she would not be forced to do so. No physical or mental harm was done to participants. The questionnaires were distributed and administered without embarrassing, offending, frightening, or harming participants. This was made possible by teachers and parents completing questionnaires from the privacy of their homes. Learners were required to complete the achievement test in a classroom setting, which was familiar to them and provided a safe environment (Leavy, 2017:32). 1.12.7 Achieving anonymity Results and participants remained anonymous - each participant was given a number. All data corresponding to the participant was linked to their given number. If any participant wished for their name to be used, a pseudonym was be given with the help of the child or parent (Leavy, 2017:107). 1.12.8 Maintaining professionalism Data, results, methods, and procedures were reported honestly. No data was fabricated, misrepresented, or falsified. Gatekeepers (parents, principal, school governing body, teachers, and learners) were not deceived with regard to the aims and procedures of the intended study (Leavy, 2017:149). 27 1.12.9 Participants' vulnerability The participants in the study were parents, teachers and learners. The participants were treated with the utmost respect and were not placed in a situation where they felt vulnerable. They could decide if they wanted to participate and to what extent they wished to respond to questions on the questionnaire (Leavy, 2017:145). 1.13 Organisation of chapters Chapter 1: Orientation

of the Study Chapter 2: Literature Review Chapter 3: Research Design and Methodology Chapter 4: Research Results Chapter 5: Conclusions and Implications 1.14 Chapter summary In this chapter, an introduction and background to the study regarding the impacts of electronic devices on the social and cognitive development of learners during the COVID-19 pandemic was done. It was followed by the problem statement and rationale for the study. The aims, objectives and research questions were stipulated in the sections that followed. The hypotheses for the study were followed by the scope and significance of the study. Operational concepts, such as electronic devices and the COVID-19 pandemic, were defined. Section 1.9 covered the preliminary literature review, conceptual and theoretical framework and a review of related empirical studies. Section 1.10 covered the research design and methodology, followed by the ethical considerations in section 1.11. The chapter concluded with the organisation of chapters, a chapter summary and references used for Chapter 1. CHAPTER 2: LITERATURE REVIEW 2.1 Introduction The onset of the COVID-19 pandemic resulted in national lockdowns and quarantine, leading to social isolation from friends and family (Chetty, Munsamy, Cobbing, van Staden & Naidoo, 2020:1). Social isolation and distancing became the norm during the ongoing pandemic. Worldwide, people are turning to electronic devices for social interaction, online learning and work. Predictions have been made that COVID-19 will transform how interactions will take place after the pandemic is completely over (Chetty et al., 2020:1). This chapter focuses on the conceptual framework, theoretical framework and a review of related empirical studies. The conceptual framework comprises the COVID-19 pandemic, electronic devices and types, followed by the social and cognitive development of learners. The theoretical framework section describes Bandura's Social Cognitive Theory and how it was implemented in this study. The final section includes reviews of related empirical studies regarding the usage of electronic devices by learners during the COVID-19 pandemic and the impact of the usage of different electronic devices on learners' social and cognitive development. The literature review chapter concludes with a summary. 2.2 Conceptual framework The conceptual framework of a study comprises the logical associations and orientation of everything that formed the basic structures, thought processes, practices and execution of the project (Kivunja, 2018:47). Crawford (2020:36) emphasised that the conceptual framework describes the main concepts to be studied, such as key factors, variables and the anticipated relationships between them. The conceptual framework examines a specific set of individuals or setting, which forms part of a larger phenomenon. A researcher links research questions to greater theoretical constructs, which shows that the research may hold significance for the relevant field (Crawford, 2020:36). Kivunja (2018:47) stated that a conceptual framework encompasses the researcher's ideas on identifying the research topic, the research problem to investigate, relevant research questions, review of literature, application of theories, methodology, data analysis and interpretation of research findings, conclusions and recommendations to be made. The conceptual framework is therefore the master plan for a research project (Kivunja, 2018:47). The conceptual framework for this study defines the following concepts: The Coronavirus (COVID-19) pandemic; electronic devices and types; the social development of the learner; and the cognitive development of the learner. 2.2.1 The Coronavirus (COVID-19) pandemic The sweeping severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) has reached upwards of 200 territories and countries across the globe (Schröder, Bossert, Kersting, Aeffner, Coetzee, Timme & Schlüter, 2021:1). The continent of China was hit first by the outbreak in January of 2020. China enforced drastic interventions, which included an almost full lockdown for eleven weeks. However, by April 2020, China reported 83,500 cases of the virus. Since April 2020 various European countries have reported upwards of 100,000 cases each, while the USA reported more than one million cases (Schröder et al., 2021:1). During this period, South Africa reported approximately 5300 cases, which escalated to 2,95 million cases and 89,791 deaths by November 2021, according to the COVID-19 South African Online Portal (2021:1). The South African National Lockdown Level 5 was announced on 27 March 2020, which included a full closure of childcare centres, primary and higher education and halting of public leisure activities. In addition, the physical distancing of 1,5 metres and a 70 per cent of shopping reduction was enforced. Only 85 per cent of the South African workforce were allowed on-site (Schröder et al., 2021:2). Schools were closed from 27 March to June 2020, and then again in August. Schools were partially opened for Grades 7 and 12, to attempt to regain some of the school days lost - which amounted to 30 to 59 schooldays lost (Timm, 2021:1). The first wave peaked at 13,900 cases in July 2020, succeeded by the second wave, during which daily cases peaked at 21,606 by January 2021 (COVID-19 South African Online Portal, 2021:2). The third wave saw cases rising more rapidly than previous waves, peaking at 16,585 daily cases by July 2021. The third wave was likely driven by a mix of social mixing, public fatigue regarding strict measures, and unsuccessful use of social measures and public health, new variants of the virus and vaccine inequity (Mwai, 2021:2-3). Africa's average death rate was 2.6 per cent for many months, which was higher than the global average of 2.2 per cent. According to Mwai (2021:3), the Delta variant of COVID-19 has been the cause of increased deaths and cases across the African continent and has been reported in more than seventeen countries by July 2021. The Delta variant cannot be tracked as easily and testing for this variant is not generally available. The South African variant, Beta, accumulated high case numbers and was detected in twenty-nine countries by July 2021. Mwai (2021:4) reported that thirty-two countries have identified a variant first identified in the United Kingdom, named Alpha. The COVID-19 pandemic's effect on Africa's long-term development has been disastrous - almost a decade of human development has been erased as reported by the Institute for Security Studies (Timm, 2021:1). According to Mhlaba (2021:3), Statistics South Africa reported that 2.2 million jobs were irrecoverable due to the economic shutdown during the pandemic. Education has been challenged globally, forcing schools to carry on teaching with online methods and implementing rotational attendance. However, some students have not returned to school and many South African households have no access to the internet or computers (Mhlaba, 2021:1,3). Shepherd and Moholwane (2021:2) stated that 10 per cent of South African parents reported that a minimum of one child per household had not attended school since the pandemic started. South African learners from Grades 1 to 12 are estimated at 12 million, which means that almost 750,000 learners aged seven to seventeen have not been attending school by May 2021. This is an increase of ±500,000 learners, compared to before the pandemic. South African Minister of Basic Education, Angie Motshekga reported in November 2021 that approximately 300,000 learners withdrew from primary schools all over South Africa over the course of six months (Mhlaba, 2021:1). Shepherd and Moholwane (2021:3) mentioned that the rate of learning loss in 2020 and 2021 was similar, due to lost school days and rotational attendance. It has been calculated that since March 2020 and June 2021 most primary school learners lost upwards of 70 per cent to a year of schooling. Teacher fatalities during the first two waves of the pandemic amounted to 2,283 (0.57 per cent of the workforce) by May 2021. No clear association has been proven between schools being open and the virus spreading more quickly (Shepherd & Moholwane, 2021:4). The academic year of 2021 proved extremely challenging for South African education, by virtue of the pandemic and infection rate of the Delta variant. The continued quarantine, economic challenges, uncertainty, loss and bereavement led to increased anxiety regarding school attendance in South Africa (Silbert & Mzozoyana, 2021:1). The reopening of schools for 2021 was intended for 27 January, however, the second wave of the pandemic hit South Africa and Level 3 lockdown restrictions were imposed and were lifted on 28 February 2021. Schools reopened on 15 February and have stayed open since then, even though many learners continued school on a rotational basis (Shepherd & Moholwane, 2021:7). However, schools were closed for a week longer in July 2021, during the third wave of the pandemic under Extended Alert Level 4 lockdown (Shoba, 2021:2). Rotational learning continued, where learners attended school on different days and implemented social distancing. Concern has arisen that when learners return after two or three days, they might already have forgotten the work taught and lessons have to be repeated. This greatly impacts the learners' proficiency of key skills, namely reading amongst Grade 1 learners, who were not in school for one full term of teaching. Shoba (2021:2) mentioned the DBE's report that almost two decades of educational gains were erased by the pandemic, which includes educational time lost and that, as a result, 78 per cent of Grade 4 learners are now unable to read skilfully, as shown by school-based assessments. Online learning has been a lifeline for some learners but is out of reach for most (Fricker & Alhattab, 2021:1). Landa, Zhou and Marongwe (2021:169) stated that teaching during emergencies like the COVID-19 pandemic relies on access to basic technology. BusinessTech (26 August 2021:1) reported that South Africa's internet access rate only stands at 64 per cent, which excludes 20 million citizens from accessing the internet and online teaching opportunities. On a global scale, the World Bank calculated that school closures impacted 1.6 billion learners. Learners from poorer communities were cut off from teaching during the school closures, since having technology for anything different from survival and acquiring crucial information was an extravagance at that time (Landa et al., 2021:169). A consequential percentage of South African learners live in rural areas, which was calculated at 66 per cent of the total learner population in 2019. The South African government faced challenges with delivering high-quality education to rural learners even before the onset of the pandemic, which only increased when online learning was imposed on teachers and learners (Landa et al., 2021:170). During the pandemic, the government attempted to save the academic year by leaping into online and remote learning, by collaborating with non-governmental organisations. Initiatives emerged focused on mobile, online and social media platforms, which included Zoom, Microsoft Teams and WhatsApp groups. Several mobile network providers provided access to zero-rated educational apps, which meant they did not use data and were essentially free (Landa et al., 2021:170). However, the effect of the pandemic can already be seen by the 5 per cent decrease in Grade 12 pass rates. Learners were especially harmed in core content areas like mathematics and science - a study from the Telkom Foundation confirmed that the absence of classroom learning caused regression in high school learners (BusinessTech 26 August 2021:1). It is apparent that the calibre of education amid the ongoing COVID-19 pandemic was impacted by less interaction, lost days of teaching and a loss of teachers (Timm, 2021:2). 2.2.2 Electronic devices and types Technology and electronic devices have developed rapidly in recent years, and most children are increasingly being exposed to these devices during early childhood (Oliemat, Ihmeideh & Alkhawaldeh, 2018:591). This era of technological development has enabled the use of electronic devices, including smartphones, computers, touchscreen tablets, TVs, and video gaming consoles by children of all ages (Oliemat et al., 2018:591). Electronic devices form part of many children's' lives, however, these devices may have negative and positive impacts when used by children at a young age (Fitriahadi & Tyastiti, 2020:34). This section will explore the literature on smartphones, computers, touchscreen tablets, televisions, and video gaming consoles. 2.2.2.1 Smartphones Cell phones developed into smartphones, which have enabled users to access a variety of applications, other than only making a basic phone call. Children begin experimenting and playing on their parents' phones as babies and toddlers (Brito & Dias, 2020:1). Golden, Blake and Giuliano (2020:6-7) mentioned previous studies that found that most infants had used smartphones before the age of one and that they are regularly preoccupied with smartphones under the supervision of their parents. Fitriahadi and Tyastiti (2020:34) found that children aged two to four spend two hours per day on smartphones. Internet access on smartphones has become more affordable, which may have led to increased usage in children, adolescents and adults alike. Brito and Dias (2020:2) reported that the favourite applications of children include games, watching videos, music, tutorials and cartoons on YouTube. They also start to research their interests on the Google search engine and use the camera and related applications to draw on and edit photos. Kamenetz (2019:3) confirms that video viewing is a firm favourite among children aged eight to twelve in the US, who spend around 2.5 hours daily on YouTube. Piñon (2019:2) reported that 24 per cent of eight to twelve-year-old US children had smartphones in 2015. Kamenetz (2019:1) reported an increase to approximately 53 per cent of US children having their own smartphones before eleven-years of age in 2019, which means one in five (19 per cent) eight-year- olds have their own smartphone. Self-reported smartphone usage by these children totals almost five hours per day (Kamenetz, 2019:3). Rich (2020:1) stated that screen content on smartphones has been made available to almost anyone, due to its compact size and touchscreen navigated service. This content includes educational applications, which aid in mathematics and language learning. These interactive applications are increasingly being used in schools to support the teaching and learning of core content and skills. Behnamnia, Kamsin and Ismail (2021:1) stated that those educational games may amplify the creativity of children while enhancing their learning, which leads to critical thinking,

problem- solving and collaboration with others. Children experience satisfaction from smartphone usage, which increases their confidence when they finish tasks and succeed in higher levels of games (Fitriahadi & Tyastiti, 2020:36). Smartphones have other positive impacts, such as self-regulation, promotion of independence, and learning by actively doing or through trial and error. They entertain and enable children to discover their interests and socialise with others (Brito & Dias, 2020:2). According to Rich (2020:2), mixed results were reported when receptive and interactive learning on smartphone screens were compared: The performance of learners increased when tasks were repeated, but learners' working memory and attentional abilities may have been overwhelmed. Fitriahadi and Tyastiti (2020:34) stated that the increasingly widespread negative impacts of smartphone usage are visible when parental control is lacking. Smartphones may also impact the social behaviour and emotional intelligence of children and may then have a negative impact when addictive behaviour towards mobile games emerges. Excessive smartphone usage during childhood has also been linked to reduced adolescent brain development, strained social relationships, increased anxiety, sleep impairment and risk of depression (Piñon, 2019:2). Smartphones may expose children to inappropriate content online, encourage sedentary behaviour and lead to inattention (Brito & Dias, 2020:2). 2.2.2.2 Computers This era of rapid technological advancement has enabled children to become computer experts from a young age (Gerwin, Kaliebe & Daigle, 2018:334). A study in the US with 1,000 parents via telephone found that 27 per cent of children aged four to six use computers daily and that such usage has become an integral part of children's lives (Mustafaoğlu, Zirek, Yasacı & Özdinçler, 2018:3). Another study in the US by Mollborn and Fomby (2020:2) found that approximately 80 per cent of children aged nine to thirteen have access to computers. Computers and laptops (portable computers) are now linked to the internet and serve a multitude of purposes, such as consumption of media, creating, working, information seeking and learning (Mollborn & Fomby, 2020:2). Enthoven, Tideman, Polling, Verhoeven and Klaver (2019:1) found that computer usage by children increased from 0.31 to approximately 0.46 hours daily at age six, to 0.74 to approximately 0.79 hours by age nine. Mastering computers at a young age has enabled huge strides to be made in children's preparedness for schooling, careers and innovative thinking. ICT (Information and Communication Technology) usage has increased in education and learning with 21st-century classrooms embracing the transformations resulting in an interactive and technologically advanced learning environment (Bagon, Gačnik & Starčič, 2018:2). Bagon et al. (2018:2,4) elaborated, saying that this learning environment was collaborative, flexible and socially connected. ICT in education is beneficial to cognitive development, literacy, motivation, communication and social skills. Learners share a belief that computer-related learning supports more productive learning conditions and is more interesting. Lupescu (2021:83) pointed out that computer usage enables learners to work more comfortably with documents and follow along with teachers' classes. Computer usage is associated with raising the efficacy of independent work and increasing success. Learning with computers also provides opportunities to search for information from various sources, while providing feedback on the learning process. Dunlap (2018:1) concurred by stating that academic software use in school leads to more progress. Interactive programmes support all learners in developing their strong points while improving weaker areas. Computer functions like email can improve learners' writing abilities and the internet can expand their worldview through the use of virtual tours to various destinations (Dunlap, 2018:1). However, it is paramount to mention that too much screen-time might impact academic performance negatively (Mustafaoğlu et al., 2018:3). Children may experience fatigue in the form of nervousness, insomnia, irritability and a decrease in their attention span when they remain seated at a computer for extended periods (Lupescu, 2021:83). 2.2.2.3 Tablets Touchscreen tablets have only been used widely for less than a decade and have increased in popularity as portable cellular devices with high-speed internet access (Mollborn & Fomby, 2020:1). Tablets offer application software and functionality similar to smartphones and computers - even preschool children have become users (Lin, 2019:119). Marsh, Lahmar, Ploughman, Yamada-Rice, Bishop and Scott (2020:284) found that six in ten children aged three to four in the UK use electronic devices to go online, while 49 per cent are using tablets for that purpose. An online survey of 198 parents of children younger than three revealed that a quarter of those children use touchscreen tablets daily for viewing cartoons, programmes and videos on YouTube. They also use tablets daily for mathematics, reading applications and easy games. Marsh et al. (2020:284), concluded that tablets are increasingly used by pre-schoolers due to their screen size, ease of use and portability. Lin (2019:119) mentions a survey of 1,500 parents with children younger than twelve, of which 10.4 per cent of those children younger than six own a tablet. Upwards of 20 per cent of those children use it for more than an hour daily and 67.6 per cent of them accessed tablets before age six. Tablets are increasingly incorporated into the school curricula worldwide. Oliemat et al. (2018:591) described that touch-based features and applications for tablets have become more affordable and are easily implemented in schools as an important learning tool, thus they are vastly improved, compared to the devices used previously. Numerous studies have reported that tablets can provide memorable learning experiences, which support development and learning (Oliemat et al., 2018:591). Tablets encourage motivation and persistence in task completion and enhance learners' interest and determination when completing tasks. Tablets help develop early 36 literacy skills and second language acquisition. Learners are also able to do homework and conduct research on tablets (Oliemat et al., 2018:592). Trifunović, Čičević, Lazarević, Mitrović and Dragović (2018:37) pointed out that learners using tablets in pairs or with adults have increased motor skills, and better geometric and mathematical thinking, enhanced critical thinking and creativity when tested. Learners develop interaction, communication and cooperation skills when working with peers on tablets and even show positive attitudes towards learning. A study of tasks completed on computers versus tablets concluded that 67 per cent of learners had correct answers on tablets, and only 49 per cent had correct answers on a computer (Trifunović et al., 2018:40). Ross (2020:2) mentioned that there are more than 15,000 educational applications available on the Apple App Store and the Google Play Store contains just as many. Tablets are also used by learners with special needs, with functions such as voice-to-text and dictated information (Ross, 2020:5). Tablet usage may also be prolonged due to the entertainment factor and convenience of use. Lin (2019:119) stated that the rapid changes of scenes and various light simulations cause tired eye muscles, which have been associated with weak visual pursuit ability. Overuse can lead to less interaction with adults, attention deficits, and impaired 3D visual-spatial perception. Frequent tablet usage may detrimentally impact the fine motor development of learners when compared with physical manipulation and grasping of toys and objects (Lin, 2019:120). However, more research is needed to confirm this. Teachers have reported that tablets can be distracting in class with their ability to take you almost anywhere virtually (Ross, 2020:11). 2.2.2.4 Television sets Televisions have been around the longest and a few channels focus exclusively on educational and informational content for children, such as Sesame Street (Gongala, 2021:3). Smart TV's enable the usage of applications like Netflix, Amazon Prime and YouTube (Thompson, 2020:1). Searches on YouTube empowers children to be their own teacher and pursue information about subjects they are intrigued by. Gongala (2021:3) asserts that educational channels offer subjects like science, history, art, mathematics and geography. Children are exposed to universal languages and different types of sports. Children are also inspired by documentaries and programmes to attempt new things and discover more interests (Gongala, 2021:4). The types of 37 programmes watched by children shape their attitudes and personalities and may influence their environmental and social awareness, and holistically promote cognitive, social and emotional development (Sabardila, Markhamah, Arifin, Kusmanto, Hidayah, Kurniasari & Saputro, 2021:588). Children's programmes teach a variety of skills, such as peer interaction, dealing with emotional trauma, navigating difficult situations and sparking the imagination through interactive quizzes. Some programmes like Sid the Science Kid, teach mathematics and problem-solving, alongside analytical thinking (Sabardila et al., 2021:589). Khanyile (2021:1) reports that South African children spend more than three hours daily in front of screens, which excludes school-related screen time. This information was stated in the 2018 Healthy Active Kids South Africa report, which also found that 94 per cent of babies and toddlers from urban and low-income households ignored the suggestion of no screen time for children younger than two (Khanyile, 2021:2). Tumbokon (2020:1) agreed by mentioning that no educational benefits are provided for children younger than two as it takes up time that could have been spent exploring, interacting and playing. Studies have shown that children with TVs in their bedrooms spend half an hour more on their TVs and are likely to be depressive, overweight, emotionally distressed, victimised, physically aggressive and have underdeveloped social skills by age thirteen (Tumbokon, 2020:1). Children bombarded by TV in the background at home experience difficulties concentrating on voices when background noise is present. This attention difficulty continues in school when learners are unable to pay attention to teachers. Therefore, an increase in TV decreases time spent talking to family members and learners struggle to adjust to aural learning, after being used to fast-paced visual stimulation on the TV. Tumbokon (2020:2) emphasised that less effective homework is completed with TV in the background and that learners in that type of environment retain less information. TV watching is also associated with less sleep, which decreases children's alertness and leads to poor school performance (Tumbokon, 2020:2). 2.2.2.5 Video gaming consoles Video game consoles are multimedia devices providing fun and entertainment, on which one can perform many activities simultaneously. Gaming consoles have risen in popularity, totalling 29.4 million worldwide shipments of PlayStation four consoles 38 and Nintendo Switch totalling 34.74 million consoles by the end of 2017 (Griffith, 2019:1). Gregory (2020:2) stated that US spending on gaming consoles during 2020 increased by 63 per cent when compared to March 2019. Paswan (2020:85) confirmed that the video gaming industry is very popular among children and adults alike, due to its high quality graphics, attractive audio and a colourful ambience. Gaming consoles contain applications such as Spotify, Hulu, Netflix and YouTube, and an app for playing Blu-Ray discs. Gaming consoles also enable video calling via Skype to connect with fellow gamers or family members, as well as function as an internet browser (Griffith, 2019:2). Gaming consoles are associated with many benefits to children. Gregory (2020:3-4) stated that gaming consoles are emotionally, socially and motivationally beneficial. Children are able to socialise in teams online, while negotiating, taking turns, collaborating and thinking critically to reach goals. Video gaming has a therapeutic value for mental health, by creating a sense of agency and having a modicum of control over outcomes (Gregory, 2020:5). Video gaming on consoles can improve mood, lessen anxiety and enhance relaxation while building emotional resilience through failed attempts and learning to deal with losses (Brennan, 2021:5). Video gaming can boost reading skills since even young players have to figure out the instructions for gameplay. Games like Minecraft, which is set in a 3D world, develop visual-spatial skills, such as distance and space. Problem-solving skills are also improved through puzzles and mysteries to be solved, alongside flexible thinking and planning. Video gaming extends imaginative play and creative thinking, as well as persistence, to achieve goals in-games and in real life (Velez, 2021:2). Excessive usage of gaming consoles has been associated with concentration issues, which directly impact school performance (Paswan, 2020:86). Video gaming may lead to sleep disruption, addiction to gaming and violent behaviour such as aggression and irritability. In rare cases, when children are addicted to gaming, they become highly irritable, experience hallucinations and physical pain, and become at risk for obesity (Brennan, 2021:2-3). Paswan (2020:86) found that excessive video gaming may impact children's ability to differentiate between reality and fantasy, which results in nightmares. Children are exposed to violence in games if not monitored by parents; which may also impact their anger management (Paswan, 2020:86). 2.2.3 The social development of the learner Social development during early childhood is regarded to be crucial in social competence (Carson, Lee, Hesketh, Hunter, Kuzik, Predy, Rhodes, Rinaldi, Spence & Hinkley, 2019:2). Social skills are classified as possessing the capability to develop positive relationships and interact with other people. Carson et al. (2019:2) described social skills as critical abilities that underlie social competence and development. Well- developed social skills in early childhood are associated with better school performance, mental health and future employment; as well as less substance abuse and criminal activity in adolescence and adulthood. Malik and Marwaha (2020:4) concurred that children who fail to follow the trajectory of social development as is expected will experience emotional and mental health problems. Possible mental health issues manifest as compulsive behavioural activities, withdrawal and minimal interest in socialising, repeated impulsive and aggressive behaviour, struggling to play with peers, minimal or no communication, stunted language development, and even a loss of prior

developmental achievements (Palmer, 2019:2). Children develop social skills through playing and interacting with siblings, peers, parents and others at home and in school settings (Carson et al., 2019:2). During the initial years of childhood, children acquire social and emotional skills, including sharing, regulating emotions and following instructions. These skills form the foundation for developing numeracy, literacy and other cognitive abilities (Palmer, 2019:1). Palmer (2019:1) stated that children experience healthy social development when they have responsive and nurturing relationships with family members and caregivers. Social development is crucial during early childhood, when children's brains are developing swiftly, including their capability to learn crucial social skills. Palmer (2019:2) advocated that social and emotional development is effected by experiences and genetics, and together they form the architecture of the brain. Children's experiences of interactions and the environment lay a strong or weak foundation, depending on the quality of these experiences (Palmer, 2019:2). Social development plays a meaningful role in school readiness, which refers to the preparedness of children to be successful in a structured learning environment (Graham, 2020:6). Social and emotional learning (SEL) is a essential for school 40 readiness and a predictor of academic success. The process of SEL includes setting and achieving positive goals, managing and understanding emotions, forming and maintaining relationships, and making responsible decisions. Social development involves experimental learning and the refining of social skills (Graham, 2020:6). Kalish (2019:2) also found that SEL enhances academic achievement and helps prevent violent behaviour and mental health issues. Social and emotional competence enables children to become self-aware, confident and manage their impulses, which leads to behavioural improvements and academic achievement. A vital SEL skill is motivation, which encompasses the achievement of goals through utilising emotional factors, persevering when faced with obstacles and enjoying the learning process (Kalish, 2019:3). ECE is full of opportunities for learners to build and practise their social skills (Palmer, 2019:3). The ECE environment should provide quality experiences since it directly impacts the degree to which children develop socially and emotionally. A high-quality environment is defined as one with warm, frequent and stimulating interactions with educators and peers, with educators being attentive to the needs of individual learners and building on the strengths of learners. Palmer (2019:4) advocated that early childhood teachers are trained to identify barriers to social and emotional development and can provide families with advice and support to address these barriers. Irshad, Maan, Batool and Hanif (2021:236) agreed that ECE is a crucial foundation for children's social competence, as well as educational and cognitive future development. Early childhood educators must provide learners with assistance and guidance to accelerate holistic development. Early childhood educators know social developmental milestones and use them as a guideline for interventions (Search Institute, 2018:1). During primary school years, learners start paying more attention to others around them, while comparing themselves to peers and attempting to fit in. Learners become more selective when choosing friends and start to make judgements about others' actions. Learners that are aged six to seven are seen with one friend, while learners aged eight to nine could have many best friends. Learners show more interest in the differences between girls and boys (Search Institute, 2018:5). Learners regularly want to play with same-gender peers, which is sometimes challenging for 41 children still developing gender identity. Learners also become aware of pre-existing stereotypes, biases and rejection based on gender, race, weight and age, even more so when they experience these biases (Search Institute, 2018:6). Early childhood development of social skills is therefore crucial to ensuring optimal brain development and social competence, to increase future academic achievement and holistic development (Kalish, 2019:4; Graham, 2020:6). 2.2.4 Cognitive development of the learner Early childhood is a time for playing, blending fiction and facts, and learning to use language to think about the world (Loalada, 2021:2). Sagar (2019:1) describes cognitive development as the ability to explore, think and understand. Early experiences form new connections in the brain. The quantity and quality of these experiences impact the strength of the synapses (brain connections) (Lang, 2019:3). Cognitive development is enhanced when learners are healthy, socially connected, and emotionally secure. The advancement of knowledge and problem-solving capabilities increases children's ability to understand the world. These skills are crucial for sensory processing and learning new things, which begin in early childhood and improve with support and practice. Crucial cognitive skills include language learning, attention, memory, processing, reasoning, solving problems, thinking, pattern recognition, and cause and effect (Sagar, 2019:1). Jean Piaget's cognitive development theory is regarded as the most comprehensive (Sagar, 2019:3). Piaget found that children continuously try to balance the way they understand the world. When children are faced with new things, they will assimilate them into their existing schema and match them with something already known, or they will accommodate the new situation by expanding their knowledge structures (Loalada, 2021:3). During school age years complex cognitive skills are developed, which carries learners through school and prepares them for learning as adolescents and adults. These complex skills include problem-solving, reasoning (complex and novel problem-solving), symbolic thought and working memory (manipulating and storing information simultaneously) development (Lang, 2019:1; Peng & Kievit, 2020:15). Peng and Kievit (2020:15) add executive functioning to the list, which encompasses the processes behind cognitive and social-emotional goal-oriented behaviours that lead to self-control, self-regulation, and flexible thinking. Piaget advocates that the cognitive development process occurs when children interact with the world (Lang, 2019:2). Primary school learners (aged between seven and eleven) form part of Piaget's concrete operational stage of cognitive development, during which learners transition from symbolic thinking to logical operational thinking. They begin to process ideas and thoughts internally (Lang, 2019:3).During this stage learners start thinking logically about events occurring concretely; the concept of conservation is developing regarding change of shape and how certain properties remain; learners can reverse things mentally (return objects to their original shape); learners become less egocentric and begin to consider other people's feelings and thoughts (McLeod, 2021:2,3). Primary school settings are structured, enabling opportunities to explore interests, connect with others, discover new skills, and use new knowledge in interesting ways, with enough time and space to process learning (Lang, 2019:5). Cognitive learning is described as an active learning style, which maximises the brain's potential to connect new information with existing schemas and increases retention and memory capacity (Valamis, 2021:2). Components of cognitive learning include comprehension, memory, and application. Learners have to understand why different subjects are learnt, which increases learning efficiency. In terms of memory, information should not be crammed, but a deep understanding of a subject should be encouraged. This increases a child's ability to relate previous life experiences with new information. Cognitive learning strategies help learners to apply new skills and information in real life situations and support the development of problem-solving skills (Valamis, 2021:3). Cognitive learning has shown many benefits, as claimed by Valamis (2021:5). It leads to lifelong learning, where learners can continue building on previous knowledge and apply new ideas. Cognitive learning encourages learners' confidence in approaching new activities, by deepening their understanding of subjects and practising new skills. Problem-solving skills are enhanced through cognitive learning, which is necessary when challenging tasks are attempted. Comprehension of new information is also improved by deepening understanding of subjects and materials (Valamis, 2021:6). Piaget summarised cognitive learning strategies of learners as accommodation (modifying what is known to account for new information), assimilation (arranging new information in their minds alongside what is known), and equilibration (balancing what is known with what they are attempting to acquire) (Valamis, 2021:7). The University of Michigan Health (2021:1) listed several cognitive development milestones for primary school learners. Learners aged seven should be able to have a stable understanding of time, grasping seconds, minutes, hours, days, weeks, months, seasons and even years. They prefer specific learning styles, such as quiet and independent or hands-on. Learners can solve simple mathematics problems concretely, by using objects. They can consider problems and issues focusing on a single factor at a time (University of Michigan Health, 2020:1). Learners aged eight should manage to skip count in two's and three's. They understand which day of the week it is, though they may not know the calendar date. Learners can read basic sentences and complete single-digit addition and subtraction sums. Learners can differentiate between left and right. Most of the time, these learners have a black or white perspective, where something is either right or wrong, beautiful or ugly (University of Michigan Health, 2020:1). Learners should have ample opportunities to ask questions, explore and learn by observing in primary school. Focusing on cognitive skills is crucial in early childhood, to enable early detection of challenges or delays and empower educators to address these issues, which can prevent learners from struggling later in life (Sagar, 2019:4-5). 2.3 Theoretical framework – Albert Bandura's (SCT) Social Cognitive Theory The SCT was created by Albert Bandura, a renowned professor of psychology at Stanford University (Vinney, 2019:1). Behavioural theories initially suggested that all learning took place due to associations formed through conditioning, reinforcement and punishment. Bandura believed that behavioural development had an important social element and that people learn through observing others' actions to gain new knowledge and then can adjust their behaviour (Bandura, 1971:2; Cherry, 2021:2). Bandura, therefore, performed an array of experiments in 1961 and 1963, to ascertain if a social behaviour such as aggression can be accrued through observation and imitation. The experiments, named the Bobo doll experiments, entailed children observing a model hitting an inflatable doll and Bandura proved that children emulate behaviour that they observed from others (Bandura, Ross & Ross, 1961:581). Bandura popularized the Social Learning Theory in 1977, which defined his perspective on learning through observation and motivation. Observational learning could explain various behaviours not accounted for in existing theories (Bandura, 1971:2; Cherry, 2021:2). Bandura adapted his theory to become the Social Cognitive Theory (SCT) in 1986, to assert the cognitive aspects of observational learning and to show how cognition, behaviour and the environment collaborate to shape the development of humans (Bandura, 1989:2; Vinney, 2019:2). The social aspect of the theory recognises the social origins of most human action and thought, whereas the cognitive aspect acknowledges the impactful causal contribution of human thought, which then affects motivation and action (Bandura, 1989:9; Beauchamp, Crawford & Jackson, 2019:110). The core concepts of SCT include learning through observation and the internal mental state of a person is crucial to the process. This theory acknowledges that just because learning took place, that does not automatically result in a behaviour change. Bandura asserted that most human behaviour is learnt through observing the behaviour of a model, which suggests how new and different behaviours are recreated. These observations are coded in the brain and may guide behaviour on later occasions (Bandura, 1989:24; Cherry, 2021:2). Various factors influence a person's ability to learn and perform new behaviours. External forces and internal thoughts influence the cognitive learning process. Behaviour and learning are therefore impacted by things seen in the environment, social interactions, observed behaviours and how they are interpreted (Bandura, 1989:21). The SCT, therefore, describes the process of learning in a social context, which involves personal factors (cognition), environmental factors and human behaviour that influence one another and is also referred to as triadic reciprocal determinism (Bandura, 1989:2; Beauchamp, Crawford & Jackson, 2019:110). The SCT encompasses several key assumptions. People acquire new behaviours and knowledge through observation of a model (Bandura, 1989:23). Learning happens in social situations, through compelling mutual interaction between the environment, the behaviour and the person (Bandura, 1989:2; LaMorte, 2019:1). Reinforcement and punishment directly impact learning and behaviour – humans develop expectations about possible consequences of responses in the future, based on the reinforcement or punishment of current responses. Cognitive factors influence whether behaviour is acquired or not, while mediational processes impact behavioural development (Bandura, 1989:2;). Past experiences are taken into account, to determine if a certain behavioural action will occur (Bandura, 1989:40; LaMorte, 2019:1). Observational learning makes use of three types of models. Live models are real life individuals acting out or demonstrating a behaviour. Symbolic models are characters portraying behaviours in films, books, online media and TV programmes. Verbal instructional models include explanations and descriptions of behaviours (Bandura, 1989:21; Cherry, 2021:3; Williams, 2018:1). Observational learning follows a sequence of four processes (Bandura, 1989:27-29; Vinney, 2019:2). Attentional processes highlight the information selected in education for observation, through the various types of models. Retention processes follow, where learners remember the observed behaviour and information, to be recalled and reconstructed successfully at a later stage. Production processes encompass the reconstruction of the memories of observations, to apply it in appropriate situations. In some

cases, the observed action will not be precisely replicated but instead is modified to produce a variation of the behaviour fitting the context. Motivational processes determine if observed behaviour is performed, based on the outcomes for the model. When the observed behaviour is rewarded, motivation to reproduce it later increases (Bandura, 1989:27-29; Vinney, 2019:2). It is also noteworthy that good role models are essential, whereas poor role models have a corrosive influence on observational learning (Williams, 2018:1). The COVID-19 pandemic impacted education since 2020 in South Africa, which mandated working and learning from home during school closures. Many learners completed schoolwork on online learning platforms, while others had no access to online resources. Many parents complained that they were busy with work at home or were unsure of how to teach online work to learners. Beauchamp et al. (2019:111) declared that daily activities and tasks are rarely performed in isolation and are usually done in interdependent and social settings. People are dependent on proxy agents to support the achievement of objectives and goals. SCT helps us to understand how people are influenced and how they also impact the environment (Valamis, 2021:4). Through observational learning, learners can acquire new knowledge quickly when they take individual responsibility and act. Teachers, peers and parents are all active models who support the development of social and cognitive skills through direct and indirect teaching (Valamis, 2021:4). Teachers use multisensory approaches in a classroom, which requires various activities (verbal, visual, tactile and kinaesthetic) when learners are acquiring a new skill; and it improves retention (Fullbrook, 2021:5). Teachers also use peer and group work when teaching new skills. Group work is beneficial to learners. Higher ability learners are grouped with struggling learners, who support and coach each other. Learners pay more attention to their peers, than when a teacher presents a lesson (Fullbrook, 2021:6). Less motivated learners are also paired with highly motivated learners, which increases their learning motivation. Learners' motivation can be intrinsic or extrinsic; the latter being the case when other learners are rewarded for the same behaviour. Motivation also increases learners' self-efficacy, which occurs when they are verbally persuaded and receive constructive feedback. When learners develop confidence and a belief in their own abilities, they will try harder to succeed (Fullbrook, 2021:4,6). SCT as theoretical framework will enable the researcher to determine how parents as models for social and cognitive learning impacted the development of learners during the COVID-19 pandemic. The researcher will also determine how the school closures and online learning impacted the social and cognitive development of the learners, who had far less school contact time with teachers and peers and were dependent on online learning, with the assistance of their parents. Adolt-Silva (2021:14) conducted a study focusing on how executive functioning skills are not taught often to learners with Attention-deficit/hyperactivity disorder (ADHD) or learning disabilities in art classrooms in Pennsylvania in the US. Adolt-Silva (2021:17) believed that teaching should include environmental models and support relationships in various modalities adaptable to each child. This supports the learning of skills inclusive of self-regulation, perspective taking, self-control, communication, taking on challenges, making connections and problem-solving. Adolt-Silva (2021:22) implemented Bandura's SCT as the study framework; specifically the dynamic reciprocal determinism concept (the interdependence of the environment, past experiences and reciprocal interactions between people). Adolt-Silva (2021:1) used a qualitative design and interviewed eight art teachers regarding their teaching practice and teaching of executive functioning skills. SCT as a framework was applied successfully and Adolt-Silva (2021:93) found that many teachers were implementing strategies that encouraged the development of executive functioning skills through planning and scaffolding. However, teachers felt that they needed professional standards and requirements for teaching these skills. Teachers embraced the triadic approach in daily classroom activities, which empowered learners with ADHD or learning disabilities to learn executive functioning skills through art. Adolt-Silva (2021:1) used the information from the teachers to create a three-day professional practice-based, development programme. Arundell, Parker, Timperio, Salmon and Veitch (2020:1) conducted a study in Australia on the major public health concern that arose from excessive screen time behaviours of parents and children at home. Arundell aimed to discover if parents' and children's screen time behaviours clustered together and to understand the correlates of the familial clusters, which would help to inform whole-family intervention strategies. The study, framed by SCT, categorised familial typologies and detected the essential adaptable correlates of the familial typologies. Parents reported the duration of screen time behaviours of their children (aged two to eleven) and themselves on devices like TV's, electronic games, computers, tablets and smartphones for work and leisure. Arundell et al. (2020:1) achieved success in identifying three familial typologies of screen time behaviours. Arundell emphasised that screen time behaviours can be affected by parental behaviours, the household setup, child preferences, role models and school policies. Rahman and Farzana (2019:2) conducted a study on children growing up with multiple digital media devices within households. Rahman and Farzana (2019) stated that children and parents spend a substantial amount of time on digital devices. Children are inclined to copy their parents, to view, imitate and also learn from their behaviours. The researchers conducted a quantitative analysis of data from 87 parents from Bangladesh and Thailand, to determine if there is a relationship between device usage by children and parents. Rahman and Farzana (2019:11) found a statistically strong significant relationship between a parent's extent of device usage, the child's device usage and age group. The findings were consistent with SCT, emphasising that children learn by observing, imitating, and modelling. Wong, Tung, Rao, Leung, Hui, Tso, Fu, Jiang, Zhao and Ip (2020:258) conducted a study aiming at disentangling the pathways of parental device usage, parent-child interaction, children's screen time behaviours and children's psychosocial difficulties of families in Hong Kong who are disadvantaged. Parents of children aged three reported on how many hours their children spent on electronic devices daily and evaluated the psychosocial behaviour of their children with the strengths and weaknesses questionnaire. Parents self-reported on their device usage and the occurrence of parent-child interaction. Wong et al. (2020:263) found that children may subsequently learn and imitate modelled screen time behaviours of parents. Parents become distracted by electronic devices in front of their children, which links parental device usage to children's screen time behaviours. Wong et al. (2020:263) reported that these parents often engage in device usage during interaction with their children. The study proved the hypothesis that children's device usage behaviours can be learned from parents, which reflects the key aspect of SCT stressing the importance of modelling and observation during the learning process. In this study, the focus is on the impact of electronic device usage on the social and cognitive development of Grade 3 (previously referred to as Grade 2) learners during the COVID-19 pandemic. Previous research has associated positive and negative impacts of electronic devices on children. The SCT as a framework will guide the questionnaires that parents, teachers and learners will complete. Parents will report on their own electronic device usage, as well as their children's screen time, which will show if learners' screen-time is closely linked with that of parents. Learners had to complete online work, without modelling and guidance from teachers and peers, which may have impacted their social and cognitive development. Some parents were too busy with their own work or were uncertain of how they could support their children with online work, while some did not complete online work at all. Teachers are able to provide information regarding the social development of learners by having continuously observed these learners' social interactions during the 2022 school year. Cognitive development with regards to mathematics is a social activity in the Foundation Phase, where all new skills are taught in small groups, where modelling of the new skills takes place and learners are supported and motivated to imitate and retain the new skills. This study, therefore, highlights the observational learning of SCT, which includes attention, retention, production and motivation (Vinney, 2019:2). 2.4 Review of related empirical studies The ongoing COVID-19 pandemic has posed huge challenges to education and childhood development worldwide (Daniel, 2020:1). This section of the study will review related empirical studies on the usage of electronic devices by learners during the COVID-19 pandemic, followed by the impact of electronic devices on learners' social and cognitive development. This section will conclude with a review of the strategies suggested by studies to mitigate the effect of electronic devices on learners. 2.4.1 Usage of electronic devices by the learners during the COVID-19 pandemic Since April 2020, more than three billion people have been sheltering at home worldwide (Wiederhold, 2020:359). Upwards of 130 countries imposed restrictions limiting the movement of their citizens in an attempt to avert the spreading of the COVID-19 virus. Wiederhold (2020:359) stated that 90 per cent of learners were cut off physically from schools, while technology became a lifeline for learners to interact with friends, play and access educational content. Screen time has been increasing even before the COVID-19 break-out. Wiederhold (2020:359) referenced a 2019 report from Common Sense Media which determined that learners aged eight to twelve in the US use electronic devices for entertainment purposes for approximately five hours per day, excluding educational usage. Learners' device usage has skyrocketed and doubled those numbers with the lack of in person interactions during the pandemic. Wiederhold (2020:359) reported that learners of all ages spend approximately three hours daily on electronic devices, which has increased to six hours daily. The real number is even higher for many learners, prompting concern regarding the potential detrimental impact of excessive screen time on learners. The increase in device usage may be necessary for online learning, social interaction, entertainment and distraction in these uncertain times, which allow their parents to work from home (Wiederhold, 2020:359). Wiederhold (2020:359) highlighted that the American Academy of Paediatrics (AAP) even suggested that screen time rules should be rethought in light of COVID-19. The AAP encouraged focusing on the screen time type, instead of the length of usage, such as using video calling to keep in touch with people. Dray (2020:1) reported that the UK government identified excessive device usage by learners as an increasing concern in April 2019. Since then, lockdown measures have driven learners to participate in online learning and social media to stay connected. Dray (2020:2) also mentioned the survey carried out in 2019 by Census Wide on 2000 families with children aged below fourteen, which found that children spend approximately twenty- three hours weekly on electronic devices. Pandya and Lodha (2020:1) concurred that the pandemic has established online teaching as the sole medium for social-emotional interactions and connection and referred to a study done by Forbes, which reported a 50 to 70 per cent increase in internet usage daily during the pandemic - 50 per cent thereof was spent on social media in 2020. A study was done in Germany by Wunsch, Nigg, Niessner, Schmidt, Oriwol, Hanssen- Doose, Burchartz, Eichsteller, Kolb, Worth and Woll (2021:2) found that screen time heightened naturally during the pandemic since adults and learners were required to use electronic devices for communication, mainly for online meetings and educational purposes. Normal daily lives were now transferred to an online environment. Wunsch et al. (2021:3) stated that the German School Barometer study, in which 1000 teachers completed a survey during the first lockdown period in 2020. The study found that 84 per cent of teachers used task sheets for teaching during the lockdown period, while only 14 per cent used video conferencing. Wunsch et al. (2021:4) conducted a longitudinal observational study of 1,711 children aged four to seventeen, with multi-stage sampling. Parents of learners under age eleven filled in the questionnaires on behalf of their children. Wunsch et al. (2021:9) noted that pre- pandemic electronic device usage by learners was directly related to heightened screen time during the pandemic and less physical activity. The study's main limitation was its use of self-reported surveys, which may be influenced by the social desirability of answers and wanting to answer in ways that do not reflect negatively on the participant (Wunsch et al., 2021:10). Dutta, Mukherjee, Sen and Sahu (2020:1) studied the impact of the lockdown in India on screen time and sleep behaviour. The researchers referred to a study by a non-governmental organisation, Child Rights and You (CRY), which reported that 88 per cent of participants experienced a tremendous increase in screen time of urban children in India. Dutta et al. (2020:1) conducted an online survey via email links and social media, to determine if screen time has detrimental effects on children aged eight to sixteen. Dutta et al. (2020:1) found that screen time did not increase with a high percentage of the 153 participants before and during the pandemic. Increases of usage were reported as smartphones at 14 per cent, TV's 4 per cent, computers at 9 per cent and tablets at 2 per cent. The study limitations were the number of participants and the lack of information about sleep disturbances pre-pandemic. More participants could provide more conclusive results (Dutta et al. 2020:1). Xiang, Zhang and Kuwahara (2020:531) studied the total time on screens of children and adolescents spent on internet use, leisure (TV and videos), computer/smartphone games, reading/studying online, homework, school lessons and social media use. The study took place in Shanghai, China and was a natural experimental longitudinal study of 2427 children aged six to seventeen, from five schools with two surveys.

Screen time was categorised into short (less than two hours daily) and long (more than two hours daily). Xiang et al. (2020:532) found that the physical activity of participants decreased substantially from nine hours per week pre-pandemic to 1.75 hours per week, which is a decrease of 435 minutes on average. Physically inactive children became increasingly prevalent, from 21.3 per cent to 65.6 per cent. Xiang et al. (2020:532) concluded that screen time increased considerably amid the pandemic averaging 1,730 minutes/30 hours weekly, while leisure screen time also increased. Lau and Lee (2021:863) conducted a study in Hong Kong, inspired by the school closures amid the pandemic. Teachers had to adapt the curriculum for distance learning to reach learners at home, who in turn needed parental support to participate in distance learning. Lau and Lee (2021:864) were concerned that learners were at risk for excessive electronic device usage during suspended classes, which may be detrimental to their development. The researchers used convenience sampling of 6707 kindergarten and primary school learners' parents in an anonymous online survey. Lau and Lee (2021:869) found that 98.8 per cent of primary school learners had to do distance learning during class suspension and received two to four assignments daily, of which 83.8 per cent were online (pre-recorded materials and other online platforms). Only 14 per cent of the learners were able to complete the online assignments without the help of their parents. Lau and Lee (2021:870) also reported that 75.7 per cent of learners used electronic devices excessively - the primary school learners (40.2 per cent) spent over two hours in front of screens for online assignments. More than half of the primary school learners (20.7 per cent) used electronic devices for two to three hours, closely followed by the 18.4 per cent of learners who used electronic devices for three to four hours (Lau & Lee, 2021:371). The limitations include conducting the research in the early stages of the pandemic and only capturing the duration of screen time (not the nature or type) (Lau & Lee, 2021:874). The answers of participants may also be subjected to self-report bias and social desirability of answers. Kovacs, Starc; Brandes, Kaj, Blagus, Leskošek, Suesse, Dinya, Guinhouya, Zito, Rocha, Gonzalez, Kontsevaya, Brzezinski, Bidiugan, Kiraly, Csányi and Okely (2021:1) conducted a multi-national, cross-sectional study in Spain, Germany, Russia, Italy and France. The study was inspired by the COVID-19 pandemic in Europe and how screen time and physical activity were affected by the restrictions, to inform adequate strategies and mitigation measures. Convenience sampling was implemented with an online survey from May to June 2020 of learners aged six to eighteen. Kovacs et al. (2021:4) used the AAP recommendation of a maximum of two hours of daily screen time as a baseline. Kovacs et al. (2021:6) found that 70 per cent of the participants exceeded two hours of screen time daily on weekdays, while almost 66 per cent exceeded screen time on weekends. Kovacs et al. (2021:10) suggested that insufficient physical activity and excessive electronic device usage are predictive of health issues and future strategies for mitigation should be designed to avoid the higher amount of screen time becoming the norm. The limitations of the study were the self-and parent-reported surveys, which may be subjected to bias in recalling and social desirability, as well as the fact that recreational screen time was not reported (only educational time) (Kovacs et al., 2021:11). Tough and Madigan (2021:2805) were concerned that existing research was limited to cross-sectional studies or used the national norms for the comparison of data. The researchers, therefore, conducted a study on how the pandemic increased recreational screen time prior to the pandemic and which COVID-19 media-related and population factors influenced the immensity of heightened screen time among learners. Tough and Madigan (2021:2805) conducted a study on the recreational screen time of 1333 mothers and their children aged five to nine in Calgary, Canada. The findings showed that COVID-19 screen time increased by 95 per cent, to approximately 23.57 hours weekly, which is an increase of eleven hours on average. Mothers who imposed screen time rules and were aware of their children's screen time activities reported less of an increase in screen time of their children, using electronic devices 3.5 hours per week. Tough and Madigan (2021:2805) also found that families struggling financially and experiencing psychological stress reported the highest elevation in screen time. The study had a few limitations, such as not addressing if the increased screen time puts children at risk, not enough detail regarding media types and context of screen time (co-viewing or educational) and what health outcomes are impacted by electronic device usage (Tough & Madigan 2021:2805). 2.4.2 Impact of the usage of different electronic devices on learners' social development The effects of electronic device usage on young children have become a concern, especially how it interrupts parent-child interactions and causes disrupted relationships (Gerwin et al., 2018:348). Schleisinger, Hirsh-Pasek and Golinkoff (2018:1) stated that 98 per cent of American households with children aged two to eight have mobile devices, which is an increase from 75 per cent in 2013, of which 45 per cent have their own mobile devices. Schleisinger et al. (2018:3) noted that research is accumulating on how social interactions drastically change when children come into contact with electronic devices. The main concern is that electronic devices are designed for solo activities, which decreases social interaction with parents eager for interaction. Books traditionally supported social interactions, motivating learners to ask questions and connect to life experiences. In contrast, electronic books discourage conversations, since they interrupt the audio narration and thereby obliterate social interactions. The conversations that take place when interacting with electronic books are more focused on how to manipulate the devices and distract the children from the story, which results in weaker listening comprehension of children aged two to five when compared to reading traditional books with parents (Schleisinger et al., 2018:3). Electronic games require the continuous attention of children and displace communication with caregivers almost completely when compared to normal play of children aged four to six with parents. Schleisinger et al. (2018:4) concluded that research is just beginning on using mobile devices and their effect on social interactions and more studies are required to comprehend the effects long-term. The American College of Paediatricians (2020:9) studied a national sample of 40,337 children aged two to seventeen in 2016 and evaluated their usage of electronic devices. The ACP found that children exposed to electronic devices for more than one hour daily showed less curiosity, more difficulty making friends, lower psychological well-being, lower self-control, less emotional stability and are difficult to care for. The American College of Paediatricians (2020:9) then conducted a meta-analysis of existing studies and referenced a study in Denmark on the relationship between depression and excessive electronic device usage. The longitudinal study followed a cohort of 435 adolescents into adulthood and found that every additional hour of electronic device usage is associated with greater chances of depression and anxiety that lead to social isolation. Another study of 300 learners found that smartphones that are close to learners on a table decrease the attention of learners during social interactions. This distraction leads to less enjoyment of social interactions (Dwyer, Kushlev & Dunn, 2018:233). The American College of Paediatricians (2020:11) noted that various studies have linked TV viewing violence with future aggressive behaviours. One study was done on Grade 3 learners and their teachers and found that media violence exposure leads to more verbally and physically aggressive behaviour. The ACP stated that violence is shown frequently in various media sources in manners that reinforce aggressive behaviour as realistic, without consequences and justifiable. The American College of Paediatricians (2020:12) points out that even parents of toddlers use smartphone games to entertain their children, who in turn start to act with aggression towards others, show decreased empathy, interpret the behaviour of others negatively, respond with violence when confronted and are less prosocial. The American College of Paediatricians (2020:12) found that upwards of 85 per cent of video games contain violence, which lessens children's ability to comprehend others' emotions and decreases children's sensitivity to emotional cues. In person social interactions are displaced by screens, which leads to a reduction in social skills (The American College of Paediatricians, 2020:12). Matthes, Thomas, Stevic and Schmuck (2021:1) noticed that parents expect excessive electronic devices used to have negative effects on family relationships and social development. Smartphones have fostered tension between children and parents since smartphones are perpetually accompanying children and causing conflicts with parents. Matthes et al. (2021:1) aimed to determine if parents' smartphone usage impacted their inability to control their children's usage of smartphones and if it is linked to conflict. Matthes et al. (2021:3) conducted a two-wave panel survey with pairs of parents and children aged ten to fourteen and took a quota sample based on gender, age and education of parents. Matthes et al. (2021:5) found that excessive smartphone use by parents directly predicts the anticipated inadequacy of parental control over the usage of smartphones by children. This lack of control also predicted conflict between children and parents regarding how children use smartphones. The study was limited by self-report measures and memory recall biases (Matthes et al., 2021:6). Ralph (2018:199) conducted an empirical case study in Canada on prosocial sharing behaviour when engaging with electronic devices, in this case, iPads. The study was framed by social learning and social exchange theories. Ralph (2018:199) implemented a mixed methods design with video ethnography. A field-study group of three preschool children aged four and one teacher was selected. Results showed that prosocial behaviours were more frequent than antisocial behaviours. The negative social behaviours comprised only 2 per cent of all behaviours. Ralph (2018:215) noticed possible negative impacts of iPad sharing, such as the occurrence of bullying. However, the teacher's presence reduced such behaviour and would have intervened. The activities on the iPad could be too fast-paced, distracting or overstimulating, but the researcher selected activities appropriate to the attention span of the learners. The limitations included generalizability, sample size and the time frame for the study. Many parents were uncomfortable with the video recording, which resulted in the small sample size (Ralph, 2018:217). Hosokawa and Katsura (2018:1) conducted a study in Japan to determine the association between the usage of mobile devices and child regulation. The researchers sampled 1,642 learners aged 6 in Grade 1 in primary schools. Parents participated in a questionnaire on the emotional behavioural adjustment and learners' usage of mobile devices. Hosokawa and Katsura (2018:1) found that 14 per cent of learners used mobile devices daily for a minimum of 60 minutes. This regular of electronic device usage is greatly linked to behaviour and conduct issues. Hosokawa and Katsura (2018:9) reported that constant electronic device usage may increase the social isolation of learners and displace opportunities for social interaction with friends and family, which are beneficial for social development. This displacement results in social and emotional behavioural issues, based on previous reports that showed more than half of computer usage at home is spent alone. Hosokawa and Katsura (2018:10) stated that constant electronic device usage is associated with children externalising problems, especially when exposed to violent programmes and games. The study had a few limitations. The cross-sectional design posed difficulties with ascertaining causality - a longitudinal design would be more appropriate. The study had a selection bias risk since unobservable factors influencing learners' electronic device usage could not be considered. The study did not include the context of device usage and may lack generalizability (Hosokawa & Katsura, 2018:1). Hinkley, Brown, Carson and Teychenne (2018:1) studied the potential connections between physical activity outdoors and screen-time with social skills of children up to age five. Hinkley et al. (2018:3) collected cross-sectional data from 575 mothers of children aged two to five with an online questionnaire. Hinkley et al. (2018:7) reported that higher screen time levels and lower physical activity were associated with weaker social skills. The limitations are the cross-sectional design, no specification of electronic devices, and the online survey may not be generalisable to the population (Hinkley et al., 2018:1). 2.4.3 Impact of the usage of different electronic devices on learners' cognitive development Empirical research on the effect of electronic devices on the cognitive development of learners is gaining popularity, enabling literature reviews by various researchers (Gottschalk, 2019:4). Danovitch (2019:81) reviewed electronic device usage and understanding of children up to eight years of age. Danovitch (2019:86) noticed that many researchers believe that extensive access to electronic devices and the internet decreases cognitive capacity and intelligence. Individuals looking for answers are now turning to electronic devices and spend less time learning from other people. However, the empirical evidence on the effects of internet-accessible devices on cognitive development is inconclusive and outcomes are inconsistent. Danovitch (2019:86) added that children could feel less obligated to recall information since they can search for it on electronic devices. This may lead to a delay in the development of essential organisational and recollection strategies. Chetty-Mhlanga, Fuhrimann, Eeftens, Basera, Hartinger, Dalvie and Röösli (2020:1) investigated the pervasiveness of various facets of electronic device usage and their correlation with neurocognitive outcomes in the rural sections of South Africa. A cohort study on learners aged nine to sixteen collected data with a questionnaire on total screen time, the duration of calls and problematic electronic device usage. The study by Chetty-Mhlanga et al. (2020:1) was one of the first done in Africa that focused on the risks and benefits of electronic device usage. Chetty-Mhlanga et al. (2020:3) found that smartphone usage

increased alongside age, from 29 per cent aged nine to eleven to 35 per cent at ages twelve to fourteen. Chetty-Mhlanga et al. (2020:9) proclaim that the high dosage of radiofrequency electromagnetic fields from electronic devices to the brain, could impair cognitive function and weaken memory. The cross-sectional design of the study is a limitation and may need continuing analyses to be able to rule out reverse causality (Chetty-Mhlanga et al., 2020:1). Blumberg, Deater-Deckard, Calvert, Flynn, Green, Arnold and Brooks (2019:1) noted the necessity of examining electronic gameplay and application usage as a context for developing cognitive skills, especially for learners aged six to twelve in middle childhood. Blumberg et al. (2019:1) noticed the gap in studies of children aged six to twelve and how electronic devices impact them when compared with studies on adults and younger children. Blumberg et al. (2019:1) attempted to highlight the current empirical evidence on young children, middle childhood and adults. Blumberg et al. (2019:5) found that the impact of electronic devices depends on the content of TV programmes. Studies have found positive long-term associations and increased academic performance in science, mathematics and English. However, exposure to TV containing violence and purely for entertainment is associated with negative impacts on cognitive development. Blumberg et al. (2019:6) point out that learners can learn basic coding skills like sequencing, loops and conditioning by using developmentally relevant applications and improve in issuing certain commands with regular practice. Educational games of high quality substantially support mathematical skills and emerging literacy. Blumberg et al. (2019:9) also mentioned that electronic games can strengthen various key cognitive abilities, including selective attention, which are crucial to acquiring academic skills and information. Vedechkina and Borgonovi (2021:1) reviewed the literature on the implications of electronic device usage (video games, TV and digital multitasking) on cognitive control and attention. Vedechkina and Borgonovi (2021:3) found that constant multitasking could interfere with the development of executive function and attention networks, which increase attentional difficulties and the vulnerability to switch tasks over having sustained focus on one task. Vedechkina and Borgonovi (2021:4) argued that most of the literature on TV viewing is of low quality and includes mainly cross-sectional and correlational studies with insignificant effect sizes. The studies are full of inconsistencies and contradicting results since the impact of electronic devices is dependent on the type of device usage, cognitive measures and the population. Vedechkina and Borgonovi (2021:4) highlighted that certain programming features like content cuts and shorter scene lengths may be detrimental to cognitive control development and overstimulate brains that are still developing. Programs without advertisement breaks are associated with positive inhibitory control, while poor control is measured when similar content with advertisements is viewed. Breaks in programming for commercials engage and re-engage attention to the screen and increase the difficulty for children to extract meaning from programming and link concepts. Vedechkina and Borgonovi (2021:5) found that several cross-sectional studies have associated TV watching amid infancy with negative cognitive aftermath later in life. Vedechkina and Borgonovi (2021:7) stated that the existing literature on video gaming mostly focused on adolescents and adults. Vedechkina and Borgonovi (2021:11) were adamant that multitasking with electronic devices caused disruptions to sustained attention and impacted self-regulation, memory, learning and motivation detrimentally. Continuous multitasking with electronic devices causes deficits in cognitive functioning related to long-term and working memory, inhibitory control and impulse responses. Multitasking with devices while learning is associated with negative impacts on academic outcomes, perceived learning and academic attitudes. The amount of time dedicated to learning and academic activities is displaced, which also limits the available attention for simultaneously processing the academic content. TV's that play in the background also weakens the quality and quantity of synchronous activities, such as sustained play and homework. Vedechkina and Borgonovi (2021:11) found several limitations of existing literature, such as the limited populations, convenience samples, cross-sectional designs and self-report instruments. Wilkinson, Low and Gluckman (2021:1) compiled a report on the influence of recreational screen time (social media, games and TV) on learners' cognitive, social and emotional development. Primary school learners in New Zealand aged five to twelve were observed and extensive associations were found between behaviour problems (hyperactivity and inattention) and executive functioning, which depended heavily on the content and type of screen time (Wilkinson et al., 2021:4). Negative correlations were discovered between video and TV watching and achievement in mathematics and executive functioning. Watching programmes and gaming for several hours daily is directly linked to hyperactivity and inattention in children aged seven. Wilkinson et al. (2021:4) also noted that screen time in general before bed harms academic achievement. The study was limited by the observational research approach, which challenges the researchers in separating the effects of screen time from various other factors that impact development. Most of the evidence was based on TV viewing, which did not accommodate newer interactive electronic devices (Wilkinson et al., 2021:6). Gottschalk (2019:14) referenced a study on TV viewing and children, which found that 10 per cent of the children who participated in a survey watched upwards of seven hours of TV daily and noted that moderate viewing may not harm cognitive development. Educational TV programmes have been associated with improved mathematics, problem-solving, literacy and science skills. Gottschalk (2019:22) critiqued the available literature on the limitations, for using parental self-reported surveys (social desirability and recall bias), small samples and cross-sectional designs. 2.5 Chapter summary The literature review chapter introduced the conceptual and theoretical frameworks, followed by a review of related empirical studies. The conceptual framework firstly covered the impact of the COVID-19 pandemic in South Africa and worldwide. Second, the different electronic devices (smartphones, computers, tablets, television sets and video game consoles) were discussed alongside some of their known effects on learners. The social and cognitive development of learners were explained and the necessity of socio-cognitive development was highlighted. Albert Bandura's Social Cognitive Theory was discussed as this study's framework. A review of related empirical studies followed the theoretical framework. Amid the COVID 19 pandemic electronic device usage by learners during the increased in all reviewed studies. The impact of the usage of electronic devices on the social and cognitive development of learners was reviewed and most of the studies reported detrimental effects on development. The literature review chapter concluded with a summary of the contents. CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY 3.1 Introduction This chapter focuses on the research methodology for the study. The post-positivism research paradigm is discussed, followed by the quantitative research approach. The ex-post facto and survey design of the study is explained, followed by the study site, population, sample size and sampling procedures. The instruments for data collection are discussed, followed by the measures of instruments' validity and reliability and piloting. This is followed by the data collection and analysis procedures. The chapter concludes with the ethical considerations for the study and the chapter summary. 3.2 Research paradigm Education research follows a systematic inquiry approach to specific issues or topics (Khatri, 2020:1435). Scientific procedures are followed to study these problems and phenomena in the social context of the problem. A research paradigm is a philosophical or theoretical background for a study, which depicts the worldview of the researcher. This perspective of the researcher functions as a lens through which a problem is examined and determines the methodological aspects that are implemented in a study (Khatri, 2020:1436). The research paradigm is post-positivism for this study. Post-positivism was established as a worldview in reaction to the limitations of positivism (Panhwar, Ansari& Shah, 2017:253). Post-positivism balances interpretivism and positivism and is, therefore, an amended form of positivism. This paradigm attends to many of the established critiques of quantitative designs while prioritizing quantitative methodology (Kankam, 2019:253). Post- positivism aims at exploring phenomena scientifically and accentuates properly understanding the perspectives of a study using multi-methods and multi-dimensions. This perspective broadens the narrow perspective of positivism to create a more inclusive way to investigate problems in the real world (Kankam, 2019:87). Many researchers in education restrict studies to qualitative perspectives while disregarding the quantitative and objective side (Panwar et al., 2017:254). Educational research achieves more success when both quantitative and qualitative aspects are included, by enhancing validity and reliability. Post-positivism prioritises quantitative data and accentuates the ability of qualitative data to strengthen findings (Panwar et al., 2017:257). Educational research is pluralistic, and all relevant aspects of educational phenomena should be investigated. Post-positivism is a flexible perspective, which reduces prejudices and personal biases of the researcher by investigating the phenomena from various angles, using different instruments (Panwar et al., 2017:254). Post-positivism as a perspective allows the researcher to investigate individuals' behaviours. This perspective values naturalistic and non-experimental research practice, in which the researcher does not control the subjects or the research environment. Post-positivism encourages the collection of data in a short period, which promotes the accurate analysis of the statistical data (Kankam, 2019:87- 88). In this study, parents, teachers and learners all give input to help determine the impact of COVID-19 and the perceived increase in electronic device usage on the socio- cognitive development of learners. The post-positivist approach allows for the study of actions, behaviours, and consequences of individuals or groups through observation, interpretation and statistical analysis. This perspective views people as sentient subjects who should be studied within their context and recognises that no scientific method is a hundred per cent accurate, since all methods have their shortcomings and limitations (Panwar et al., 2017:255-256). Post-positivism is therefore a fitting approach to this study which enables accurate interpretation and in-depth analysis of research done empirically (Kankam, 2019:88). 3.3 Research approach: Quantitative Educational research is becoming progressively reliant on data to chronicle phenomena, explain changes, gather empirical evidence, and create theories for analytical reasoning when suggestions are proposed to alter educational policy (Yue & Xu, 2019:516). The research approach for this study is quantitative. Hakizimana (2016:16) stated that a quantitative approach is associated with the positivist and post- positivist research paradigm in general. Quantitative research focuses on collecting data and converting it to a numerical format, which then enables the researcher to perform statistical calculations and draw appropriate conclusions. The hypothesis of the study contains a prediction of the anticipated relationship among the variables (Hakizimana, 2016:16). The hypothesis of this study states the predicted relationship between the COVID-19 pandemic and the perceived increase in electronic device usage and their impact on the socio-cognitive development of learners. The quantitative research approach emphasises the use of a variety of instruments and materials (computer tests, surveys, and questionnaires) and a definite plan of action (Hameed, 2020:10). The data collected by these various means have to follow a strict procedure and are converted to a numerical format for statistical analysis, which enables the researcher to calculate the degree to which the variables are correlated. This relationship could be causal or a simple association (Hakizimana, 2016:16). Objectivity is crucial in quantitative research - the researcher should avoid results being affected by personal attitudes and behaviours and examine methods and conclusions drawn for possible bias. The data collected in quantitative research can be categorised, formed into units of measurement, or be ranked (Ahmad, Wasim, Irfan, Gogoi, Srivastava & Farheen, 2019:2829). Quantitative research methods should measure what they claim to measure, and external factors should be controlled to avoid any impact on the results. This is not always a possibility, but should still be considered (Hakizimana, 2016:17). The emphasis in quantitative research is on deductive reasoning and a top-down approach, which moves from general to specific. The conclusions drawn from collected data are reliant on prior statements, conditions and findings, which increase validity (Hameed, 2020:10). Inductive reasoning elements may be included in the study. Samples in quantitative research are representative of the wider population and random sampling is preferred (Hakizimana, 2016:17). The researcher aims to generalise findings beyond the context of the study, which is why the sample should be representative. Quantitative research also specifies the procedures followed in a study, to enable the replication of the study elsewhere (Hakizimana, 2016:18). 3.4 Design of the study This study followed an ex-post facto and survey design. Ex-post facto studies are undertaken when the researcher identifies a current event or an event that already occurred. The event in the current study was the outbreak of the COVID-19 pandemic and its disruption of schooling since 2020. The researcher collects data to demonstrate the possible correlation between the contextual factors and the subsequent changes in behaviours or characteristics of participants (Rahman, 2021:29). The researcher mainly reports on what is happening or what has happened, and no direct manipulation of the independent variable takes place (Ismail, 2021:5). The treatment or experience took place before the study began (Rahman, 2021:30). Ex-post facto studies are dependent on systematic empirical investigation, even though the researcher does not have direct

control over the independent variables and this research is mostly descriptive. The researcher describes the contextual conditions of the situation and aims to determine the causes and reasons for the phenomena under investigation (Kabir, 2016:9). An ex-post facto study is designed to compare two or more samples, which can be compared based on a specific occurrence. The focus is on what happens differently for the groups compared and intends also to determine if the individuals have different experiences (McMillan & Schumacher, 2014:31). The researcher wants to determine in this study whether COVID-19 increased electronic device usage and if this had an impact on the socio-cognitive development of learners. The learners were grouped according to their screen time: minimal usage (one to two hours daily), average usage (three to five hours daily), and high usage (6+ hours daily). The researcher was hereby able to compare the different groups and ascertain how they were impacted differently by the COVID-19 pandemic and the perceived increase in electronic device usage. This study also implemented a survey design, which is one of the most widely used quantitative research designs in social research (Leavy, 2017:100). This design enables researchers to gather data from large samples and thereafter, make generalisations regarding the larger population. Survey designs are implemented to explore the beliefs, attitudes, and opinions of individuals, while also reporting on their behaviours and experiences. This design is cross-sectional, where data is collected at a specific time (Leavy, 2017:101). Data was collected from parents, teachers and learners in early 2022, while the COVID-19 pandemic was still ongoing. 3.5 Study site The study site for this research is a preparatory school in Cradock. Cradock is a rural town in the Eastern Cape. Cradock and its two townships, Michausdal and Lingelihle, are located next to the Great Fish River. Cradock has been surrounded by farms for two centuries and produces agricultural products (Meyers-Mashamba, 2021:3). Cradock forms part of the Chris Hani District and has twenty schools, ranging from pre-primary to high schools. This culturally and ethnically diverse town is populated by Caucasian, Black, Coloured, Indian and Chinese people (Municipalities, 2016:1). The school where the study was conducted is a reflection of the population of Cradock, Michausdal and Lingelihle. The school has four classes per grade - from Grades 1 to 3, of which two are English Home Language classes and the other two are conducted in the Afrikaans Home Language. It is a public school and is technologically advanced. Teachers at the school have access to laptops, projectors, visualisers, and interactive whiteboards in all of the classrooms. The school prioritises the safety of learners, which is ensured by remote-controlled gates and security cameras in all classrooms and around the terrain. 3.6 Population, sample size and sampling procedures The key population comprised of learners who were in Grade 1 in 2020 and were in Grade 2 when the study began. These learners progressed to Grade 3 in 2022 and remain crucial to the study. The full population of is therefore the parents of the Grade 3 learners, the Grade 3 learners and their teachers at a preparatory school in Cradock. The learners were in Grade 1 when the COVID-19 pandemic was at its worst in South Africa in 2020 and the National Lockdown occurred. These learners missed out on approximately five months of classroom teaching. They had to complete curricular activities on Google Classroom and on worksheets, where parents were their primary teachers while the learners were staying at home. Grade 1 is a crucial foundation for all further learning, and it was severely disrupted by the national lockdown. The parents of these learners also participated in the study, to give insight into the electronic device usage of the learners at home. The Grade 3 teachers participated in the Social Development Questionnaire about the learners. They worked closely with the learners and observed their social interactions. The teachers could answer the questions honestly, without worrying about the social desirability of answers, whereas parents answered questions about their children's social development in a manner that they deemed socially desirable. The first sample for the study was the parents of the Grade 3 group of 2022, which included 108 learners in total. One parent per child was invited to complete the first questionnaire on the time spent by learners on electronic devices. After the completion of the first instrument, the learners were grouped by their levels of electronic device usage, namely minimal usage (one to two hours daily), average usage (three to five hours daily), and high usage (6+ hours daily). Ten learners were sampled from each category to participate in the remaining two questionnaires. The teachers complete a questionnaire based on their observations of the social development of learners and the learners completed a mathematics achievement test for cognitive development. The sample size for the remaining instruments, therefore, totalled thirty, and the four Grade 3 teachers completed the Social Development Questionnaire regarding the learners individually. The sampling method was purposive random sampling, which is a variation of stratified purposive sampling. This method requires a randomised selection of a small number of participants from the larger population. This method of sampling seeks out the best cases for the research project to produce the most relevant and best data to answer the research questions. This strategy is used when qualitative results can strengthen the quantitative findings (Leavy, 2017:79; McMillan & Schumacher, 2014:429). The third questionnaire that the teachers completed contained a qualitative component, which comprises semi-closed ended questions on which the teachers may elaborate. Leavy (2017:79) asserted that purposive sampling leads to richer data since the participants are strongly related to the topic. This method also makes the transfer of findings between cases possible, based on their similarities, which then enables the researcher to make inferences about a case based on the findings of a different case (Leavy, 2017:80). The main sample of 108 Grade 3 learners, their teachers and their parents were purposefully selected since they produced the greatest impact in the Foundation Phase. The ten learners per category were randomly selected after all participants (with linked numbers) were sorted by their levels of electronic device usage. The Google Random Number Generator was used to sample the total of thirty learners from the groups. 3.7 Instruments for data collection Data was collected by means of three questionnaires. Hakizimana (2016:32) stated that questionnaires are a useful way of collecting data from a great number of people, which includes people who are too busy to participate in interviews and experiments. Questionnaires offer participants the ability to take their time, think about answers and continue the questionnaire at a convenient time. Questionnaires allow participants to state their views privately, which may contribute to more honest answers and lessen their desire to give socially acceptable answers (Hakizimana, 2016:32). Questionnaires usually include multiple-choice questions, attitude scales or open- and closed ended questions. Researchers may also administer questionnaires in person. Google Forms were used to create the questionnaires. Google Forms are used widely to create surveys with ease and allow for different question types, such as grids, linear scales, multiple selections, short answers, and paragraphs (Melo, 2018:1). It is a free online tool, with which surveys can be created by anyone with a Google account. Each form has a unique link that can be sent to participants via social media, email and WhatsApp. All feedback from participants is stored and Google Forms are integrated with Google Sheets (spreadsheets), which enables the researcher to convert data to a spreadsheet for analysis. Google Forms allows users to collect the email addresses of participants and limit the number of times participants may submit their answers (Melo, 2018:1). The first questionnaire was the Screen time Questionnaire. The link to the questionnaire was forwarded on the WhatsApp groups of the Grade 3 classes by the teachers. The parents who agreed to participate in the survey received receive the printed consent forms, as well as the assent forms for their children. The parents had a week to complete the questionnaire via the link provided. The questions included the following: Personal information: Child's name and surname: Child's age: Child's gender: Child's ethnicity: Please indicate which of the following devices your child has access to (check all that apply): Does your child suffer from any chronic medical condition? (Please select all that apply) Screen time: 1. How many hours daily did the learner use these electronic devices for entertainment before the pandemic? 2. How many hours daily did the learner use these electronic devices for entertainment during the pandemic? 3. How many hours daily did the learner use electronic devices for educational activities before the pandemic (educational games or Google Classroom)? 4. How many hours daily did the learner use electronic devices for educational activities during the pandemic (educational games or Google Classroom)? 5. How many hours daily did the learner play together with friends or siblings on electronic devices before the pandemic? 6. How many hours daily did the learner play together with friends or siblings on electronic devices during the pandemic? 7. How many hours did you spend on electronic devices together with the learner before the pandemic? 8. How many hours did you spend on electronic devices together with the learner during the pandemic? The data collected from the Screen time Questionnaire was analysed and learners were grouped according to their levels of electronic device usage, namely minimal usage (one to two hours daily), average usage (three to five hours daily), and high usage (6+ hours daily). Ten learners per group were then randomly selected, totalling thirty participants. The second and third questionnaires were conducted at about the same time. The Social Development Questionnaire was sent via WhatsApp to the four Grade 3 teachers. The teachers answered the questions with regard to the thirty learners participating in the study who are in their classes. The teachers had two weeks to complete the questionnaire. The questionnaire contained the following questions and worked with a rating scale: Rating scale: 1. Poor 2. Fair 3. Good 4. Very Good 5. Excellent Participant number: 1. The learner cooperates in group settings. 2. The learner spends a lot of time talking with peers. 3. The learner builds lasting friendships. 4. The learner demonstrates growing independence from parents. 5. The learner demonstrates problem-solving, negotiating and compromising skills with peers. 6. The learner is aware of their own scholastic performance. 7. The learner demonstrates empathy and compassion. 8. The learner participates in elaborate fantasy play and interactive games. 9. The learner can identify and describe emotions and reflect on the motives of others. 10. The learner demonstrates sportsmanship - and can cope better with losing. 11. The learner enjoys playing with same-gender peers. 12. The learner participates in group games where they create their own rules. 13. The learner shows concern for fairness and justice. 14. The learner demonstrates sharing with peers. The third instrument was completed by the learners, which was an achievement test in questionnaire form. The achievement test included questions on each focus area of Mathematics in Grade 3, namely Numbers, Operations and Relationships; Patterns, Functions and Algebra; Space and Shape; Measurement; and Data Handling. The Cognitive Development Questionnaire was printed out for the learners to complete, after which the researcher recorded their answers on the Google Form. The achievement test contained the following questions: Participant number: 1. Make groups of five and count the balls. 2. 154 + 179 = 3. 26 x 5 = 4. 69 ÷ 3 = 5. Sort the numbers from smallest to largest: 6. Tim has 145 pens. He gives 118 pens to Tom. How many pens does Tim have left? 7. Halve 192: 70 8. Count how much money is in the picture: 9. Complete the number pattern: 140, 144, 148, _____, _____, _____, _____, 168 10. Name the shape: 11. Can the shape roll or glide? 12. Draw the line of symmetry: 13. What time is it? 14. Which two instruments do we use to measure mass? Circle them: 15. Which two children read between 5 and 10 books? The learners completed the achievement test in groups of ten at school in the afternoon. They had an hour to complete the test. 3.8 Measures of instruments' validity and reliability and piloting The validity of a research instrument is represented by measuring what it is intended to measure (Setia, 2017:259). Validity is the extent to which information obtained from questions is systematically different in relation to the concept's meaning, questions related to the same concept, and hypotheses or theories about the anticipated connection to the concepts (Setia, 2017:259). The instruments in this study were subjected to face validation. Face validation is regarded as a personal judgement of the instruments, which is done by an expert in the subject area. The instruments are assessed by the researcher after their design and are evaluated for their appropriateness and relevance on the 'face of it' (Setia, 2017:259). Experts evaluate the questionnaires for unambiguity, relevancy, clarity and reasonability. The instruments should therefore be uncomplicated and instructions easy enough to be followed while being at an appropriate level of difficulty (achievement test) (Desai & Patel, 2020:164). These instruments were judged by two experts in ECE and Care. These experts used the categorical options of "Yes" and "No" to indicate the favourability of questions, after which their responses were be analysed using Cohen's Kappa Index (CKI) to calculate the validity of the instruments. A minimum rating for Kappa is 0.60 for inter-rater agreement (Taherdoost, 2016:29). Based on the evaluations of the experts, the researcher modifies the instruments. Face validation was done by two experts on the three instruments with a total of thirty- one questions. The CKI for the instruments was calculated as 0.89, which is an acceptable inter-rater agreement. The researcher adjusted the questions pointed out by the experts according to their suggestions, which mainly prompted increasing the difficulty level of the mathematics achievement test and including sums that require a specific method to solve. The reliability of the instruments was determined after they had been validated. The reliability of the

instruments is the degree to which the measurement of an occurrence provides dependable results (Taherdoost, 2016:33). The modified instruments were subjected to pilot testing with three learners, three parents and three Grade 3 teachers. The data collected from these participants will not be used in the main data collection and analysis. The data from the two survey questionnaires (Screen time Questionnaire and Social Development Questionnaire) will be subjected to the Cronbach Alpha reliability estimates, which determine the internal consistency indices of the questionnaires. A pilot study should have a reliability of 0.60 or higher (Taherdoost, 2016:33). The data from the Screen time Questionnaire was measured at a reliability of 0.77, while the Social Development Questionnaire measured 0.65 on the reliability index. Both of these instruments were therefore considered reliable. On the other hand, the data obtained from the mathematics achievement test was subjected to the Kuder-Richardson formula twenty reliability test. This determines the internal reliability of a test with only two answers: right and wrong. The instrument should have a reliability score of 0.7 or higher (Taherdoost, 2016:33). The data collected from the mathematics achievement pilot test was calculated at a reliability score of 0.76, which therefore confirms the reliability of the cognitive development instrument. 3.9 Data collection procedures Data collection followed a set procedure of two phases. The first phase started with a letter that has been sent to the principal of the school and the Eastern Cape Department of Education to ask permission to conduct the study with the parents, learners and teachers of the school. Permission was granted by both parties to conduct the study. Second, the researcher determined the validity and reliability of the instruments by conducting the pilot test with three parents, three learners and three Grade 3 teachers. The Screen time Questionnaire and the Social Development Questionnaire were sent to the parents and teachers respectively on WhatsApp. The teacher participants had one week to complete the questionnaires for the pilot test, while the ten learners completed the achievement test during the same week. The researcher determined the validity and reliability of the instruments as discussed in the previous section and modified the instruments accordingly. The second phase of the data collection process started with the researcher sending the link for the Screen time Questionnaire to the Grade 3 teachers and asking them to share it with their class groups on WhatsApp. Parents who indicated that they and the learners wanted to participate in the study, received the consent and assent forms to complete and send back. The parents then had a week to complete the questionnaire. After the parents completed the questionnaire, the researcher sorted the learners into the levels of electronic device usage, namely minimal usage (one to two hours daily), average usage (three to five hours daily), and high usage (6+ hours daily). Ten learners per category were randomly selected by the Google Random Number Generator, which totalled thirty participants. The Social Development Questionnaire was sent to the Grade 3 teachers along with their consent forms, in which they agreed to confidentiality regarding the names and information about the learner participants. The teachers only completed the questionnaire about those learners enrolled in their classes. The teachers had two weeks to complete the questions for each of the thirty learners. During that two-week period, the researcher conducted the mathematics achievement test (Cognitive Development Questionnaire) with the learners. The researcher scheduled three sessions during which the achievement test was completed by the learners in groups of ten, after school. Each group had one hour to complete the test on the printout Google Forms. The researcher remained in the classroom to ensure that the participants completed the test without any disturbances and offered guidance to the participants if necessary. Afterwards, the researcher recorded the answers selected by the participants on the Google Form. 3.10 Data analysis procedures Quantitative research provides potentially important information and can be analysed descriptively or inferentially (Kaur, Stoltzfus & Yellapu, 2018:60). Descriptive statistics may comprise of measures of central tendency, measures of frequency, and variation, whereas inferential analysis, can help to draw associative, causative or other conclusions from the data collected (Kaur et al., 2018:60-61). The quantitative data was compiled using online Google Form Questionnaires, of which the responses was converted to Google Sheets. Descriptive statistics was used to define and outline data in order to answer the research questions, while inferential statistics was used to test the hypotheses. The data was specifically, analysed using frequency, percentage and mean to answer the research questions while the hypotheses was tested at a 0.05 level of significance using analysis of variance (ANOVA). In terms of descriptive analysis, the measure of the frequency of the data was expressed as a percentage, which is a way of describing a proportion as a fraction of 100 (Kaur et al., 2018:61). Measures of central tendency describe the complete set of data as one measurement, which include the mean, mode, and median. The mean is the sum of the data set values divided by the total number of observations, or the arithmetic average of the data set (Kaur et al., 2018:61). The median is the value in the middle of the distribution of data ranked in order from ascending to descending (or vice versa). The mode is the value that is most common in the data set (Kaur et al., 2018:61). The measures of variation describe the degree to which the values of a variable are identical or diverse, which includes the range, variance and standard deviation of the data. The variation and standard deviation measure the spread of closeness of each observed value to the mean of the data set (Kaur et al., 2018:62). The inferential data analysis was done by the ANOVA, which is widely used when comparing multiple groups in research (Chen, Xu, Tu, Wang & Niu, 2018:61). The ANOVA model extends the normal t-test that compares two groups, to allow for more than two groups to be compared on one independent variable. ANOVA enables testing the disparities among all groups and draw more accurate probability conclusions, which is more difficult if a series of separate t-tests are used (Chen et al., 2018:63). The statistical formula of ANOVA uses the variances of the groups to calculate a value reflecting the severity of disparities between the means. ANOVA calculates an F statistic (F-ratio), which enables the researcher to find the level of significance and reject or confirm the null hypothesis (Chen et al., 2018:63). The data from the Screen time Questionnaire was analysed first, to allow the researcher to group the learners according to their levels of electronic device usage. This was achieved by calculating the average daily time spent on electronic devices by each participant in Google Sheets. The data collected on the manner in which learners spend their time on electronic devices and other activities was analysed by measuring central tendency and variation. The data from the Social Development Questionnaire and the Cognitive Development Questionnaire (achievement test) was then analysed descriptively and inferentially, to determine if there is a correlation between the time spent on electronic devices amid the COVID-19 pandemic and the socio-cognitive development of learners. Once the analysis was concluded, the results of the descriptive and inferential analysis were represented visually. Measures of frequency and variation were presented in tables, histograms or bar graphs for easy interpretation (Kaur et al., 2018:61). The inferential statistics were presented in tables and a box plot to showcase the variations between the three groups (Chen et al., 2018:63). 3.11 Ethical considerations Ethical considerations are crucial to social research (Leavy, 2017:24). These considerations come into play immediately when a topic is selected for the study. The selection of a topic depends on the values of the researcher, the understanding of current problems requiring research, and the impact that the research will potentially have (Leavy, 2017:24). All the aspects regarding the people involved in the study are ethical decisions, which include participant selection, interactions with participants, relationships in the research, and the dissemination of research findings to interested parties and those who benefit from the research (Leavy, 2017:24). The researcher, therefore, has a responsibility to plan the study with ethical considerations in mind, which include gaining entry, the participant's right, informed consent, confidentiality, protection from harm, achieving anonymity, maintaining professionalism, and the participants' vulnerability. 3.11.1 Gaining entry Gatekeepers for the research project were contacted per email and asked for permission and consent to perform the study (Leavy, 2017:135). The gatekeepers for this project are the ECDOE, the school governing body, the principal, teachers, and parents of the learners. The gatekeepers were informed of the aims of the study and all relevant information. The study was conducted with respect to all gatekeepers. Permission was granted for the researcher and learner participants to remain on the school grounds after school on pre-arranged dates for the duration of the achievement test. 3.11.2 Participants' right Participants have a right to ask questions and participation is voluntary (Leavy, 2017:157). Participants may ask the researcher for clarification on completing the achievement test. Parents give their approval for their children to participate in the study. If the learner is unwilling to complete the achievement test for the study, he or she can refuse participation. Consent was checked up continuously - a learner, teacher or parent may change his or her mind. An opt-out letter was sent to parents, which they only complete and send back if they did not want their child to participate. This also gave the learner the opportunity to decide if he or she wants to participate. A participant can withdraw from the study without penalties. 3.11.3 Informed consent Consent was informed. The study aims and methods were described to the principal, school governing body, teachers, parents, and learners in written form. Parents and teachers completed a consent form with all of the relevant information regarding the study and their roles in it, which included the title of the research, research methods and procedures, the intended outcomes of the research, possible risks and benefits of participation, the voluntary nature of participation, steps to ensure confidentiality, compensation for participation, and contact information for the principal investigator (Leavy, 2017:34). Parents also filled in a consent form regarding the participation of their children. The research was also be explained to the learners in a manner that they understood, through a PowerPoint Presentation. The researcher explained the benefits of the intended research to the target population and made it clear that they were in no manner being exploited (Leavy, 2017:157). 76 3.11.4 Obtaining assent Parents were informed about all aspects of the study and asked to give approval for their children to participate in the study. However, Leavy (2017:36), points out that if parents or legal guardians give their consent, learners may be asked to assent to the study. Therefore, learners agree to participate after being informed about the study and any potential for risk or harm. Assent is obtained when minors are old enough to comprehend that they are volunteering to participate and may refuse without penalty. Children are generally considered old enough at nine years of age (Leavy, 2017:36). Parents and learners completed the informed assent form if they choose to participate in the study. The assent form contained the crucial information regarding the study in simple terms, to enable the participants to understand what they assent to participate in. 3.11.5 Confidentiality All responses given via the questionnaires were confidential. No visual data was collected. The data collected and the participants of this study were not discussed with anyone not involved in the study. The names of the learners were only known by the researcher and the teachers participating in the study, who signed a confidentiality statement. Numbers were assigned to learners to ensure that they cannot be linked to participants after the study (Leavy, 2017:117). All data containing information about the participants was stored on a computer protected by a password and also on Google Drive. The data will be erased after five years. 3.11.6 Protection from harm Participants were not caused distress. If a parent did not want a child to participate, he or she were not forced to do so. No physical or mental harm were done to participants. The questionnaires were carried out without embarrassing, offending, frightening, or harming participants (Leavy, 2017:32). This was made possible by teachers and parents completing questionnaires from the privacy of their homes. Learners completed the achievement test in a classroom setting, which is familiar to them and a safe environment. The school gate was locked as per school regulations to ensure the safety of learners. All COVID-19 protocols were followed when learners participated in the mathematics achievement test in the school classroom. Participants were not harmed by the reporting of the collected data - no references to individuals were made. 3.11.7 Achieving anonymity Anonymity was firstly achieved by keeping the name of the school anonymous. Results and participants remained anonymous - each participant was given a number. All data corresponding to the participant was linked to their given number. If any participant wished for their name to be used, a pseudonym was given with the help of the child or parent (Leavy, 2017:107). It was not possible to identify any participant in the reporting and analysis of the collected data. All hard and soft copies of the data is stored safely for a maximum of five years, after which it will be destroyed. 3.11.8 Maintaining professionalism Data, results, methods, and procedures were reported honestly. No data was fabricated, misrepresented, or falsified. Gatekeepers (parents, principal, school governing body, teachers, and learners) were not deceived with regard to the aims and procedures of the intended study (Leavy, 2017:149). The researcher conducted the study in a manner that reflected respect for the participants, benefited the wider community, and protected vulnerable populations (children). The researcher gave credit to the contributions of other researchers and avoided plagiarism. 3.11.9 Participants' vulnerability The participants in this study were

parents, teachers and learners. The participants were handled with respect and not placed in a situation where they felt vulnerable. They could decide if they wanted to participate and to what extent they wanted to respond to questions on the questionnaire (Leavy, 2017:145). The questionnaires were designed in a manner that determined the social and cognitive development of the learners without embarrassing the participants or pointing fingers at anyone. The intent of the study was to enlighten parents, teachers and the ECDOE about the impact of the perceived increase in screen time on the social and cognitive development of learners. This may encourage these parties to address the possible developmental delays to ensure the holistic development of learners. 3.12 Chapter summary This chapter explained the use of post-positivism as a research paradigm, along with the quantitative approach to the research. The ex-post facto and survey design of the research was elaborated on. This chapter also addressed the study site, population, sample size and sampling procedures for the study. This was followed by the discussion of the three instruments for data collection and how the instruments will be validated and tested for reliability with pilot testing. The data collection and analysis procedures were stated, followed by the ethical considerations for the study. The next chapter will present the research findings and analysis on the impact of electronic devices during the COVID-19 pandemic on the socio-cognitive development of Grade 3 (Grade 2 of 2021) learners. CHAPTER 4: RESEARCH RESULTS 4.1 Introduction This chapter will present and explain the research findings from the five research questions, to provide an answer to the research main question and hypothesis. The results will be presented according to the themes that emerged during the research processes. The data was generated from learners, their parents and their teachers, which generated mainly numerical data and qualitative data from semi-closed ended questions in the Social Development Questionnaire. Firstly, the respondents in this study will be discussed. The time spent by Grade 2 (which are now in Grade 3 in 2022) learners on electronic devices before the COVID-19 pandemic will be presented next, alongside the time spent by these learners on electronic devices during the pandemic. The next section will focus on the levels of usage of electronic devices by the learners. Finally, the impact of the different levels of electronic device usage on the socio-cognitive development of the learners will be discussed. The chapter will conclude with a summary of the themes that were discussed. 4.1.1 Themes that emerged from the study The impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio- cognitive development 1. The amount of time spent by Grade 2 learners on electronic devices before and during the COVID-19 pandemic 1.1. Television 1.2. MP3 Player 1.3. Cell Phone 1.4. Tablet 1.5. Video Game Console 1.6. Computer 1.7. Educational Games / Google Classroom 1.8. Parent and child engaged with electronic devices 1.9. Total daily screen time 2. The levels of electronic device usage by learners during the COVID-19 pandemic 2.1. Minimal usage 2.2. Average usage 2.3. High usage 3. The impact of different levels of electronic device usage on the social development of learners 3.1. Social interaction with peers 3.2. Social interaction with parents 3.3. Social play 3.4. Individual social skills 4. The impact of different levels of electronic device usage on the cognitive development of learners 4.1. Mathematical errors 4.2. Numbers, operations and relationships 4.3. Patterns, functions and algebra 4.4. Space and shape 4.5. Measurement 4.6. Data handling 4.7. Total impact on cognitive development Table 1: Themes that emerged from the study 4.2 Respondents The Screen time Questionnaire was forwarded to the parents of the 108 Grade 3 (Grade 2 in 2021) learners via the class WhatsApp groups of the four Grade 3 teachers. The questionnaire remained open for responses for a week, after which the questionnaire was closed on Google Forms. The Google Form initially collected fifty- nine responses, of which two were duplicates and were removed from the exported Google Sheet. Therefore, fifty-seven responses were collected and used in the data analysis and selection of the thirty participants for the remaining two questionnaires, which is 52.7 per cent of the total population of the Grade 3 group. The cognitive development achievement test was carried out in the last week of term 2 of 2022, and the Social Development Questionnaire link was sent to the Grade 3 teachers a week prior. This allowed the researcher to compile all remaining data in two weeks. 4.3 The amount of time spent by Grade 2 (Grade 3 in 2022) learners on electronic devices before and during the COVID-19 pandemic 4.3.1 Television Responses by participants indicate that forty-eight learners had access to a television. The total number of hours spent on viewing television by the learners before the pandemic amounted to 91 hours daily, which increased to 125 hours during the pandemic. Television viewing, therefore, increased by 37.3 per cent during the pandemic. Before the pandemic, learners watched up to 5 hours of television, with an average of 1.89 hours daily. The mode and median for television viewing were two hours daily before the pandemic. During the pandemic, television viewing by learners reached more than six hours daily, with an average of 2.5 hours. The mode and median were also two hours daily during the pandemic. The variance of the data relating to before and during the pandemic, was 1.27 and 2.03 respectively - which points to a greater degree of dispersion between responses amid the pandemic. The standard deviation before and during the pandemic, was 1.12 and 1.42 respectively - which indicates that there is a slightly larger dispersion of the responses around the mean during the pandemic. 4.3.2 MP3 player Only two learners make use of an MP3 player. Before the pandemic, these learners spent a total of 2.5 hours daily listening to music on an MP3 player. During the 81 pandemic, these learners spent a total of 4 hours daily on an MP3 player. Since there were only two learners who make use of an MP3 player, the impact of this device is insignificant. 4.3.3 Cell phones According to the responses, forty-two learners have access to cell phones. The total number of hours spent on cell phones by the learners before the pandemic amounted to fifty-nine hours daily, which increased to 83.5 hours during the pandemic. Cell phone usage, therefore, increased by 41.5 per cent during the pandemic. Before the pandemic, learners spent up to five hours on cell phones, with an average of 1.39 hours daily. The mode for cell phone usage was 0.5 hours daily before the pandemic, while the mean was one hour. During the pandemic, cell phone usage by learners reached more than six hours daily, with an average of 1.5 hours. The mode and median were one hour daily during the pandemic. The variance of the data relating to before and during the pandemic, was 1.24 and 2.09 respectively - which shows a greater degree of dispersion between responses amid the pandemic. The standard deviation before and during the pandemic, was 1.11 and 1.44 respectively - which indicates that there is a slightly larger dispersion of the responses around the mean during the pandemic. 4.3.4 Tablet Responses show that only fourteen learners have access to tablet devices (IPad, Samsung Tablet, etc.). The total number of hours spent on tablets by the learners before the pandemic amounted to 19.5 hours daily, which increased to 32 hours during the pandemic. Tablet usage, therefore, increased by 64.1 per cent during the pandemic. Before the pandemic, learners spent up to four hours on tablets, with an average of 1.39 hours daily. The mode for tablet usage was 0.5 hours daily before the pandemic, while the median was 0.75. During the pandemic, tablet usage by learners reached more than six hours daily, with an average of 2.28 hours. The mode was one hour daily during the pandemic, while the median was 1.5 hours daily. The variance of the data relating to before and during the pandemic, was 1.61 and 2.88 respectively - which shows a larger degree of dispersion between responses during the pandemic. The standard deviation before and during the pandemic, was 1.27 and 1.69 respectively - which shows a slightly larger dispersion of the responses around the mean during the pandemic. 4.3.5 Video game console According to the responses, only nine learners had access to video game consoles. The total number of hours spent on video game consoles by the learners before the pandemic amounted to eight hours daily, which increased to fifteen hours during the pandemic. Video game console usage, therefore, increased by 87.5 per cent during the pandemic. Before the pandemic, learners spent up to two hours on video game consoles, with an average of 0.88 hours daily. The mode and median for video game console usage was one hour daily before the pandemic. During the pandemic, video game console usage by learners reached up to four hours daily, with an average of 1.66 hours. The mode and median were one hour daily during the pandemic. The variance of the data relating to before and during the pandemic, was 0.20 and 1.72 respectively - which points to a large degree of dispersion between responses during the pandemic. The standard deviation before and during the pandemic, was 0.45 and 1.31 respectively - which indicates a larger dispersion of the responses around the mean during the pandemic. 4.3.6 Computer A total of seventeen learners had access to computers. The total number of hours spent on computers by the learners before the pandemic amounted to seventeen hours daily, which increased to 26.5 hours during the pandemic. Computer usage, therefore, increased by 55.8 per cent during the pandemic. Before the pandemic, learners spent up to two hours on tablets, with an average of one hour daily. The mode for computer usage was 0.5 hours daily before the pandemic, while the median was one hour. During the pandemic, computer usage by learners reached up to three hours daily, with an average of 1.65 hours. The mode was 0.5 hours daily during the pandemic, while the median was one hour. The variance of the data relating to before and during the pandemic, was 0.35 and 1.58 respectively - which indicates a larger degree of dispersion between responses for during the pandemic. The standard deviation before and during the pandemic, was 0.59 and 1.25 respectively - which also shows a slightly larger dispersion of the responses around the mean during the pandemic. 83 4.3.6 Educational games / Google Classroom Parents reported that only thirty-nine learners used electronic devices for educational purposes before the pandemic, which increased to fifty-four learners during the pandemic. The total number of hours spent on electronic devices for educational purposes by the learners before the pandemic amounted to 76.5 hours daily, which increased to 118 hours during the pandemic. Electronic device usage for educational purposes, therefore, increased by 54.2 per cent during the pandemic. Before the pandemic, learners spent up to four hours on electronic devices for educational purposes, with an average of 1.96 hours daily. The mode was 0.5 hours daily before the pandemic, while the median was two hours. During the pandemic, electronic device usage for educational purposes by learners also reached up to four hours daily, with an average of 2.18 hours. The mode was one hour daily during the pandemic, while the median was two hours. The variance of the data relating to before and during the pandemic, was 1.73 and 1.66 respectively - which indicates a degree of dispersion between responses which is very close to one another. The standard deviation before and during the pandemic, was 1.31 and 1.29 respectively - which also shows an almost similar dispersion of the responses around the mean. 4.3.7 Parent and child engaged with electronic devices together According to the responses, all parents indicated that they are engaged with electronic devices with their children. The total number of hours spent engaged with devices together before the pandemic amounted to 101 hours daily, which increased to 139 hours during the pandemic. Electronic device usage together by parents and children, therefore, increased by 37.6 per cent amid the pandemic. Before the pandemic, parents and learners spent up to six hours on electronic devices together, with an average of 1.83 hours daily. The mode and median for were two hours daily before the pandemic. During the pandemic, electronic device usage by learners and parents was reported to reach over six hours daily, with an average of 2.43 hours. The mode was three hours, while the median was two hours daily during the pandemic. The variance of the data relating to before and during the pandemic, was 1.53 and 2.46 respectively - which points to a larger degree of dispersion between responses during the pandemic. The standard deviation before and during the pandemic, was 1.23 and 1.57 respectively - which indicates a slightly larger dispersion of the responses around the mean during the pandemic. 84 4.3.8 Total daily screen time The total daily screen time of the fifty-seven learners before the pandemic amounted to 198 hours, which increased to 280.5 hours amid the pandemic. The total daily screen time of learners, therefore, increased by 41.6 per cent during the pandemic. Figure 1: Daily electronic device usage in hours Before the pandemic, some learners used electronic devices for up to 10 hours daily, with an average of 3.6 hours daily. The mode and median for daily screen time were three hours before the pandemic. During the pandemic, daily screen time reached up to eighteen hours daily for some learners, with an average of five hours. The mode was three hours daily during the pandemic, while the median was 3.5. The variance of the data relating to before and during the pandemic, was 5.90 and 14.17 respectively - which points to a very large degree of dispersion between responses for before and during the pandemic. This indicates that some learners are exceptions and engage more with electronic devices than the average learner. The standard deviation before and during the pandemic, was 2.42 and 3.76 respectively - which points to a slightly larger dispersion of the responses around the mean during the pandemic. It is clear that the amount of time spent on electronic devices increased significantly during the pandemic. 4.4 The levels of electronic device usage by learners during the COVID-19 pandemic 4.4.1 Minimal usage Learners who made use of electronic devices for up to two hours daily during the pandemic, were categorised as minimal usage participants. Responses from parents 85 indicated that sixteen learners fell into the minimal usage category.

These sixteen learners accounted for 21.5 hours and 7.66 per cent of the total daily electronic device usage reported in the Screen time Questionnaire. The mean for the minimal usage group was 1.34 hours of daily screen time amid the pandemic. The mode was two hours daily, while the median was 1.5 hours. The variance for the group was 0.52, which indicates that the responses within the group has a small degree of dispersion. The standard deviation for the group is 0.72, which indicates that the responses within the group are dispersed closely to the mean. 4.4.2 Average usage Learners who made use of electronic devices for between two to six hours daily during the pandemic, were categorised as average usage participants. Responses from parents indicated that twenty learners fell into the average usage category. These twenty learners accounted for 71 hours and 25.3 per cent of the total daily electronic device usage reported in the Screen Time Questionnaire. The mean for the average usage group was 3.55 hours of daily screen time amid the pandemic. The mode and median were three hours daily. The variance for the group was 0.87, which indicates that the responses within the group has a small degree of dispersion. The standard deviation for the group is 0.93, which indicates that the responses within the group are dispersed closely to the mean. 4.4.3 High usage Learners who made use of electronic devices for upwards of six hours daily during the pandemic, were categorised as high usage participants. Responses from parents indicated that twenty-one learners fell into the high usage category. These 21 learners accounted for 188 hours and 67.02 per cent of the total daily electronic device usage reported in the Screen time Questionnaire. The mean for the high usage group was 8.95 hours of daily screen time amid the pandemic. The mode and median were eight hours daily. The variance for the group was 9.95, which indicates that the responses within the group have a very large degree of dispersion. One learner was reported to use electronic devices daily for up to eighteen hours, while others spent as much as eleven and thirteen hours on these devices. The standard deviation for the group is 3.15, which indicates that the responses within the group have a large degree of dispersion from the mean. 86 4.5 The impact of different levels of electronic device usage on the social development of learners 4.5.1 Social interaction with peers 4.5.1.1 Group cooperation The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of their group cooperation, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.6 (72 per cent), while the average and high usage groups had a mean of 2.9 (58 per cent) and 2.4 (48 per cent). The mode of the minimum usage group was three, while the average and high usage groups had a mode of 4 and 1, respectively. The variance for the minimum, average and high usage groups are 1.44, 1.69, and 1.84 respectively - which indicates a growing degree of dispersion between the responses within the groups. The standard deviation reflects the slightly increasing dispersion between the minimum, average and high usage groups, which are 1.2, 1.3, and 1.35, respectively. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of group cooperation. The minimum usage learners had three outliers: One learner fights often when in a group, while the other two offer minimal input. The average usage group also had two outliers: One learner did not participate in group activities at all, while the other waited for others to contribute rather than offer a solution. The high usage group had four negative outliers and one positive. The positive outlying participant is very social and able to lead and follow in a group. The other participants were unable to work with other children; let others do the work; and are too shy to participate in group work. It is clear from the quantitative and qualitative data that the high usage learners have struggled more than the other two groups to master group cooperation skills. 4.5.1.2 Conversing with peers The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they converse with their peers, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.7 (74 per cent). In comparison, the average and high usage groups had a mean of 3.1 (62 per cent) and 2.7 (54 per cent). The mode of the minimum usage group was 3, while the average and high usage groups had a mode of 4 and 2, respectively. The variance for the minimum, average and high usage groups are 1.01, 1.09, and 1.61 respectively - which indicates a slight growing degree of dispersion between the responses within the groups. The standard deviation reflects the slightly increasing dispersion between the minimum, average and high usage groups, which are 1.00, 1.04, and 1.26, respectively. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of conversing with peers. The minimum usage learners had two comments: One learner only converses with close friends, while the other one was showing development in this skill. The average usage group had three outliers: Two learners are overly talkative in class, while the other one is very introverted. The high usage group had four outliers: Two participants are too talkative, while the other two are quiet and do not socialise. It is clear that the high usage learners have not developed this skill as well when compared to the other two groups. 4.5.1.3 Building lasting friendships The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they develop lasting friendships and handle peer pressure, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.6 (72 per cent), while the average and high usage groups had a mean of 2.9 (58 per cent) and 2.6 (52 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mode of 3 and 2, respectively. The variance for the minimum, average and high usage groups are 1.64, 0.49, and 1.44 respectively - which indicates a varying degree of dispersion between the responses within the groups. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.28, 0.7, and 1.2, respectively. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of building lasting friendships. The minimum usage learners had one comment: The learner changes friends frequently and do not sustain friendships. The average usage group also had one outlier: The learner fights often with friends. The high usage group had two comments: The two participants do not socialise with peers. The quantitative and qualitative data visibly show that the high usage learners have not developed this skill as well when compared to the other two groups. 4.5.1.4 Problem-solving, negotiating and compromising The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they use problem-solving, negotiating and compromising when interacting with peers, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.4 (68 per cent), while the average and high usage groups had a mode of 2.3 (46 per cent) and 2.1 (42 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mean of 2 and 1, respectively. The variance for the minimum, average and high usage groups are 2.44, 0.81, and 1.69 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the minimum usage learners' ratings vary the most. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.56, 0.9, and 1.3, respectively. It is clear that both the average and high usage learners have not developed this skill as well when compared to the minimum usage group. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of problem-solving, negotiating and compromising when interacting with peers. The minimum usage learners had two comments: Both learners argue with friends and struggle with compromise. The average usage group had two outliers: One learner often complains of being bullied and is often the instigator, while the other learner rather argues and fights. The high usage group had four outliers: One learner is good at sorting out problems, while the other four learners are those who complain often, keep quiet at school and complain at home, and are the cause for complaints. It is clear that the high usage learners are struggling more with problem-solving, negotiating and compromising when compared to the other groups. 4.5.1.5 Sharing with peers The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they demonstrate sharing with peers, which is a social skill that learners should develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.8 (76 per cent), while the average and high usage groups had a mean of 2.9 (58 per cent) and 3.1 (62 per cent). The mode of the minimum and average usage groups was three, while the high usage group had a mode of four. The variance for the minimum, average and high usage groups are 0.76, 0.69, and 1.29 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the minimum and average usage groups show a smaller degree of dispersion of the ratings. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 0.81, 0.83, and 1.13, respectively. It is apparent that the minimum usage demonstrates sharing with peers the best, while the average usage learners have to work on improving this skill most when compared to the other groups. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they share with peers. The minimum usage learners had one outlier: The learner does not share often but does share with friends. The average usage group had no outliers. The high usage group also had one outlier: The learner is very caring and shares often. 4.5.2 Social interaction with parents 4.5.2.1 Growing independence from parents The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they develop growing independence from their parents, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.4 (68 per cent), while the average and high usage groups had a mean of 2.3 (46 per cent) and 2.6 (52 per cent). The mode of the minimum usage group was two, while the average and high usage groups had a mode of 2 and 3, respectively. The variance for the minimum, average and high usage groups are 1.64, 1.01, and 1.44 respectively - which indicates a varying degree of dispersion between the responses within the groups. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.28, 1.00, and 1.2, respectively. It is clear that both the average and high usage learners have not made as much progress in developing this skill when compared to the minimum usage group. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of growing independence from parents. The minimum usage learners had three comments: One learner has an overly controlling parent who does not allow for opportunities to be independent; the second learner has uninvolved parents; the other learner depends on her mother to handle any issue at school on her behalf. The average usage group had five outliers: Three learners are struggling in class due to absent parents, while the other two demonstrated strong dependency on their parents who does everything for them. The high usage group had four outliers: Two learners are showing progress in this area, while the other one is very independent of her parents. It is clear that the average and high usage learners are more dependent on their parents than the minimum usage group. 4.5.3 Social play 4.5.3.1 Fantasy play and interactive games The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they participate in fantasy play and interactive games, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.5 (70 per cent), while the average and high usage groups had a mean of 2.5 (50 per cent) and 2.6 (52 per cent). The mode of the minimum usage group was three, while the average and high usage groups had a mode of 2 and 3, respectively. The variance for the minimum, average and high usage groups are 1.45, 0.65, and 1.44 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.20, 0.86, and 1.2, respectively. It is clear that both the average and high usage learners have not mastered this skill when compared to the minimum usage group. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they participate in fantasy play and interactive games. The minimum usage learners had no outliers. The average usage group had two outliers: Both learners do not participate in these types of games. The high usage group had one outlier: The learner does not participate in these types of games. It is clear that the average and high usage learners participate less in fantasy play and interactive games. 4.5.3.2 Playing with same-gender peers The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how much they play with same-gender peers, which is a social preference that learners showcase by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 4 (80 per cent). In comparison, the average and high usage groups both had a mean of 3.2 (64 per cent). The mode of all groups was four. The variance for the minimum, average and high usage

groups are 0.8, 0.56, and 0.96 respectively - which indicates a small varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 0.89, 0.74, and 0.97, respectively. It is apparent that all three groups have shown this preference to some extent, of which the minimum usage group shows a stronger preference. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how much they play with same-gender peers. The minimum and average usage learners had no comments. The high usage group had only one comment: The learner showed no preference for gender when it comes to friends. 4.5.3.3 Playing group games with own rules The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they participate in group games and create their own rules, which is a social skill that learners demonstrate by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.5 (70 per cent). In comparison, the average and high usage groups had a mean of 2.8 (56 per cent) and 2.5 (50 per cent) respectively. The mode of the minimum and average usage groups was three, while the high usage group had a mode of two. The variance for the minimum, average and 92 high usage groups are 1.25, 0.76, and 1.05 respectively - which indicates a small varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.11, 0.87, and 1.02, respectively. It is clear that the minimum usage group has shown the most progress in this skill when compared to the other two groups. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they participate in group games and create their own rules. The average usage and high usage learners had no comments. The minimum usage group had only two comments: One learner did not participate in these games, while the other argued about the rules. Qualitatively, the minimum usage group demonstrated more difficulties in participating in group games and creating their own rules. 4.5.4 Individual social skills 4.5.4.1 Awareness of scholastic performance The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how much they are aware of their scholastic performance, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 4 (80 per cent), while the average and high usage groups had a mean of 2.8 (56 per cent) and 3 (60 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mode of 2 and 3, respectively. The variance for the minimum, average and high usage groups are 1.2, 0.56, and one respectively - which indicates a varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.09, 0.74, and one respectively. It is clear that both the average and high usage learners lag behind when compared to the minimum usage group. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how much they are aware of their scholastic performance. The minimum usage learners had one comment: The learner has demonstrated immense improvement. The average usage group had two 93 outliers: One learner does not perform to his best ability and knows it, while the other learner does not do anything to improve. The high usage group had three outliers: All three learners are not performing well and making no effort to improve. It is clear that the minimum usage learners are more aware of their scholastic performance and make an effort to improve when compared to the other two groups. 4.5.4.2 Empathy and compassion The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they show empathy and compassion towards others, which is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.7 (74 per cent), while the average and high usage groups had a mean of 3 (60 per cent) and 2.6 (52 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mode of 4 and 1, respectively. The variance for the minimum, average and high usage groups are 1.41, 1.2, and 2.04 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the high usage group shows the highest degree of dispersion. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.18, 1.09, and 1.42, respectively. It is apparent that both the average and high usage learners did not make as much progress in developing this skill when compared to the minimum usage group. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they show empathy and compassion towards others. The minimum usage learners had one comment: The learner does not really show empathy. The average usage group had three outliers: One learner is caring towards others, while the other two learners show no emotion and laugh instead of showing remorse. The high usage group had two outliers: One learner shows no emotion, while the other does not appear to care much. It is apparent that the average and high usage learners struggle more with showing empathy and compassion towards others when compared to the minimum usage learners. 4.5.4.3 Identify and describe emotions, reflect on motives The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they can identify and describe emotions, as well as reflect on the motives of others. This is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.4 (68 per cent), while the average and high usage groups had a mean of 2.6 (52 per cent) and 2.4 (48 per cent). The mode of the minimum usage group was three, while the average and high usage groups had a mode of 3 and 1, respectively. The variance for the minimum, average and high usage groups are 1.64, 1.04, and 1.84 respectively - which indicates a varying degree of dispersion between the responses within the groups. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.28, 1.01, and 1.35, respectively. It is clear that both the average and high usage learners are developmentally behind regarding this skill when compared to the minimum usage group. The teachers were asked to describe the social behaviour of participants that stand out from the rest of the learners in the group in terms of how well they could identify and describe emotions, as well as reflect on the motives of others. The minimum usage learners had two comments: One learner does not talk to anyone in the class, while the other struggles to understand the emotions of others. The average usage group had two outliers: One learner always states that nothing is wrong, while the other learner does not interact with others. The high usage group had one outlier: The learner does not react or respond to the emotions of others. It is evident that all three groups struggled with identifying and describing the emotions of others. 4.5.4.4 Demonstration of sportsmanship The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they demonstrate sportsmanship. This is a social skill that learners develop by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3 (60 per cent), while the average and high usage groups had a mean of 2.6 (52 er cent) and 2.1 (42 per cent). The mode of the minimum usage group was two, while the average and high usage groups had a mode of 3 and 2, respectively. The variance for the minimum, average and high usage groups are 1.6, 0.24, and 1.29 respectively - which indicates a varying degree of dispersion between the responses within the 95 groups, where the average usage learners' ratings are the most similar. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.26, 0.48, and 1.13, respectively. It is apparent that all three groups have not yet mastered this skill. The teachers were asked to describe the social behaviour of participants that stood out from the rest of the learners in the group in terms of how well they demonstrated sportsmanship. The minimum usage learners had three comments: Two learners do not participate in sport, while the other one does not cope well with losing. The average usage group had three outliers: All three learners do not participate in any sports. The high usage group had five outliers: These learners are reportedly too emotional and do not cope well with losing. It is evident that the average and high usage groups struggled with demonstrating good sportsmanship, while some learners in the minimum usage group did not even participate in any sports. 4.5.4.5 Concern for fairness and justice The Grade 3 teachers rated the learners from 1 (Poor) to 5 (Excellent) in terms of how well they show a concern for fairness and justice, which is a social skill that learners demonstrate by the age of eight (Grade 2) (Kid Central, 2018:1). The minimum usage group had a mean of 3.7 (74 per cent), while the average and high usage groups both had a mean of 2.8 (56 per cent). The mode of the minimum usage group was five, while the average and high usage groups had a mode of 4 and 2, respectively. The variance for the minimum, average and high usage groups are 1.21, 1.36, and 1.36 respectively - which indicates a slight varying degree of dispersion between the responses within the groups. The standard deviation reflects the slightly varied dispersion between the minimum, average and high usage groups, which are 1.1, 1.16, and 1.16, respectively. The data shows that both the average and high usage learners have yet to demonstrate this skill properly when compared to the minimum usage group. The teachers were asked to describe the social behaviour of participants that stood out from the rest of the learners in the group in terms of how well they showed concern for fairness and justice. The minimum usage learners had no outliers. The average usage group had one outlier: "The learner only cares about himself and how he is affected." The high usage group also had one outlier: "The learner does not seem to care much about fairness and justice." The qualitative data, therefore, suggest that the average and high usage learners showed less concern for fairness and justice. 4.5.5 Total impact on social development The totals for the ratings of each participant were calculated and used to determine the social development of the three groups. The minimum usage group had a mean of 3.6 (72 per cent) in total, while the average and high usage groups had a mean of 2.8 (55 per cent) and 2.6 (52 per cent). The overall mode of the minimum usage group was five, while the average and high usage groups had a mode of 3 and 1, respectively. The variance for the minimum, average and high usage groups are 1.09, 0.52, and 1.02 respectively - which indicates a varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the most similar overall. The standard deviation reflects the varied dispersion between the minimum, average and high usage groups, which are 1.04, 0.72, and 1.01, respectively. Figure 2: Social development scores of participants as a percentage (%) out of 100 It is evident that both the average and high usage learners have to improve on their social development skills when compared to the minimum usage group overall. The minimum usage group had the most ratings of five (Excellent), whereas the high usage group had mostly ratings of one overall. Figure 3: ANOVA test for social development ANOVA was calculated for the three groups to determine if the data was statistically significant at $p < 0.05$ to reject or accept the null hypothesis. The f-ratio was calculated at 2.81, which indicated that the variation between the means of the groups was higher than what could be expected to be seen by chance. The p-value was calculated as 0.077, therefore, the result is insignificant at $p < 0.05$ and indicates strong evidence for the null hypothesis. However, the data clearly shows that there was an impact on the social development of the learners in the three groups, where the minimum usage group demonstrated the most progress in the development of the social skills of eight- year-olds. 4.6 The impact of different levels of electronic device usage on the cognitive development of learners 4.6.1 Mathematical errors The errors made by the learners were categorised as Computational/Careless errors and conceptual (comprehension) errors. Computational/Careless errors occur when learners do not pay attention or work too fast, which leads to careless errors or errors with calculations (subtracting, adding, multiplying or dividing incorrectly) (Lake, 2016:3). Conceptual errors are made when learners misunderstand the concepts underlying a mathematical problem and make use of incorrect logic, which therefore points to errors in comprehension (Lake, 2016:4). Figure 4: Mathematical errors made in the cognitive development test The data indicated that 123 errors were Computational/Careless and 101 were conceptual errors. The number of conceptual errors indicates that the learners have a lack of understanding of the mathematical concepts and have trouble reading and interpreting questions with the necessary insight. The Computational/Careless errors are evidence that learners are not yet confident in their calculations and make unnecessary mistakes. 4.6.2 Numbers, operations and relationships 4.6.2.1 Counting The first question instructed the learners to count the number of balls (95) and use grouping to simplify the counting process. According to the Mathematics CAPS document, Grade 2 learners should be adept with counting up to 200 objects in groups of 1's, 2's, 3's, 4's and 5's (Department of Basic Education, 2011:18). Grade 3 learners should be able to count at least 500 objects by term 2 (Department of Basic Education, 2011:379). The minimum usage learners struggled with this question

and only 30 per cent answered correctly. The average usage group had a success rate of 80 per cent, while the high usage group only had two (20 per cent) correct answers for Question 1. Most of the learners attempted to count the balls in 1's and eight learners made Computational/Careless errors while counting. Nine conceptual errors were made, where learners simply guessed the number of balls or wrote down an illogical number. The data suggests that learners have not yet mastered the skill of counting, even 99 though it was a Grade 2 learning outcome, since 56.6 per cent of answers were wrong. However, the average usage group had the most success with this question. 4.6.2.2 Addition Question 2 had learners use a context-free addition calculation to solve 154 + 179 = □. The Mathematics CAPS document states that Grade 2 learners should be adept with using context-free calculations, such as breaking up numbers, to solve addition sums that total 99 (Department of Basic Education, 2011:22). By Term 2 in Grade 3, learners should be able to calculate addition sums up to 400 (Department of Basic Education, 2011:384). The minimum usage learners had six (60 per cent) correct answers. The average usage group had a success rate of 80 per cent, while the high usage group only had four (40 per cent) correct answers for Question 2. The data shows that twelve Computational/Careless errors were made while learners were adding the numbers, especially when the totals were added to find the answer. The data suggests that learners have room for improvement with addition sums since 40 per cent of answers were wrong. It is also clear that the average usage group had the most success with this question. 4.6.2.3 Multiplication Question 3 asked learners to multiply 26 x 5 = □. Learners are expected to break up the number, multiply and add the answers to find the total. According to the Mathematics CAPS document, Grade 2 learners should be adept with multiplying 1 - 10 with 2, 3, and 4, with a total of 50 (Department of Basic Education, 2011:22). In Grade 3, learners should be adept with multiplying with 2, 3, 4, 5, and 10 to a total of 99 (Department of Basic Education, 2011:393). The minimum usage learners had seven (70 per cent) correct answers. The average and high usage groups had a success rate of 60 per cent for Question 3. The data shows that ten Computational/Careless errors were made while learners were adding the totals to find the answer. One participant made a conceptual error, which clearly shows that the learner did not comprehend the mathematical calculation required to solve the sum. The data suggests that learners have room for improvement with multiplication sums since 36.6 per cent of answers were wrong. The minimum usage group had a slightly higher success rate with this question. 4.6.2.4 Division Question 4 had learners divide 69 ÷ 3 = □. Learners are expected to break up the number, divide and add the answers to find the total. The Mathematics CAPS document states that Grade 2 learners should be adept with breaking up numbers and divide evenly, with fifty as a maximum (Department of Basic Education, 2011:21). In Grade 3, learners should be able to divide any number up to 100 (Department of Basic Education, 2011:385). The minimum and average usage learners had six (60 per cent) correct answers. The high usage group had a success rate of 50 per cent for Question 4. The data indicates that ten Computational/Careless errors were made while learners were adding the totals to find the answer or counting incorrectly while dividing. Three participants made conceptual errors, which clearly show that they do not comprehend the mathematical calculation required to solve the sum. The data shows that learners have yet to master division sums since 43.3 per cent of answers were wrong. The minimum and average usage groups had a slightly higher success rate with this question. 4.6.2.5 Sorting numbers Question 5 asked the learners to sort the numbers from least to greatest (211, 112, 221, 122, 201, 222). According to the Mathematics CAPS document, Grade 2 learners should be adept with describing and sorting numbers up to 99, while Grade 3 learners can sort numbers up to 500 by term 2 (Department of Basic Education, 2011:21,380). The minimum usage learners had five (50 per cent) correct answers. The average usage group had a success rate of 60 per cent, while the high usage group only had three (30 per cent) correct answers for Question 5. The data shows that sixteen Computational/Careless errors were made while learners were sorting the numbers, namely sorting from largest to smallest and putting 201 after 112. The data suggests that learners have room for improvement with sorting numbers since 53.3 per cent of answers were wrong. It is also clear that the average usage group had slightly more success with this question. 4.6.2.6 Story sum (subtraction) Question 6 was a story sum in which learners had to use subtraction to solve the problem (245 - 188 = □). The Mathematics CAPS document states that Grade 2 101 learners should be adept with solving contextual problems through addition and subtraction with totals of up to 99, by breaking up numbers (Department of Basic Education, 2011:21). By term 2, Grade 3 learners are expected to solve contextual problems with totals up to 400 (Department of Basic Education, 2011:384). The minimum usage learners had eight (80 per cent) correct answers. The average usage group had a success rate of 30 per cent, while the high usage group only had two (20 per cent) correct answers for Question 6. The data shows that seventeen Computational/ Careless errors were made while learners were subtracting the numbers with an arrow sum method. This method was introduced to learners in Grade 2 and was used consistently afterwards. The data suggests that learners have not yet mastered subtraction with the taught method since 56.6 per cent of answers were wrong. The minimum usage group had great success with this question. 4.6.2.7 Halving and doubling Question 7 had learners halve 197, which required them to use a fraction (½). According to the Mathematics CAPS document, Grade 2 learners should be able to write fractions such as ½ and be able to double and halve numbers up to ninety-nine without context (Department of Basic Education, 2011:22). By Term 2 in Grade 3, learners should be adept with doubling and halving numbers context-free up to 500 (Department of Basic Education, 2011:383). The minimum and high usage learners had six (60 per cent) correct answers. The average usage group had a success rate of 40 per cent for Question 7. The data shows that twelve Computational/Careless errors were made while learners were adding the totals to find the answer or halving seven incorrectly. Two participants made conceptual errors, which clearly show that they do not comprehend the mathematical calculation required to solve the sum. The data shows that learners have to improve on halving numbers since 46.6 per cent of answers were wrong. The minimum and high usage groups had a slightly higher success rate with this question. 4.6.2.8 Money sums Question 8 asked learners to count a collection of 5 cent, 10 cent, and 20 cent coins to a total of 165 cents or R1,65. The Mathematics CAPS document states that Grade 2 and Grade 3 learners should be adept with identifying all South African banknotes and coins, as well as be able to solve money sums with totals and change of up to 102 R99 and 90 cents (Department of Basic Education, 2011:21). The minimum and high usage learners had 3 (30 per cent) correct answers. The average usage group had a success rate of 20 per cent for Question 8. The data shows that fifteen Computational/Careless errors were made while learners were counting the cents. Conceptual errors were made by seven learners, which clearly show that they do not comprehend how to count money. The data shows that learners have plenty of room for improvement on counting money since 73.3 per cent of answers were wrong. The minimum and high usage groups had a slightly higher success rate with this question but still struggled immensely. 4.6.3 Patterns, functions and algebra 4.6.3.1 Number patterns Question 9 had learners complete a number pattern by counting in 4's from 141 to 169. According to the Mathematics CAPS document, Grade 2 learners should be adept with copying, extending and describing easy number patterns up to 200 (Department of Basic Education, 2011:24). By Term 2 in Grade 3, learners should be able to count onward and backwards from any number up to 500 in 1's, 2's, 3's, 4's, 5's, and 10's (Department of Basic Education, 2011:399). The minimum usage learners had three (30 per cent) correct answers. The average and high usage groups had a success rate of 50 per cent for Question 9. The data indicates that seventeen Computational/ Careless errors were made while learners were counting on in 4's. It is evident that learners have yet to master counting in even and uneven number patterns since 56.6 per cent of answers were wrong. The minimum and high usage groups had a slightly higher success rate with this question but still struggled. 4.6.4 Space and shape 4.6.4.1 Naming 3-D shapes Question 10 featured a picture of a pyramid for which learners had to name the Three- Dimensional Shapes (3-D). The Mathematics CAPS document states that Grade 2 learners should be adept with recognising and naming 3-D shapes such as balls, boxes and cylinders (Department of Basic Education, 2011:26). By the end of Grade 3, learners should be adept with identifying and naming pyramids and cones as well (Department of Basic Education, 2011:403). The Grade 2 and 3 teachers confirmed that they taught the learners all of the 3-D shapes in Grade 2 and do revision on all of the shapes continuously. The minimum usage learners had five (50 per cent) correct answers. The average usage group had a success rate of 30 per cent, while the high usage group had four (40 per cent) correct answers for Question 10. The data shows that eighteen conceptual errors were made - most of the learners identified the shape as a cone, which indicates a lack of understanding of the properties of 3-D shapes. The data suggests that learners have to work more concretely with 3-D shapes since 60 per cent of answers were wrong. It is also apparent that the minimum usage group had slightly more success with this question. 4.6.4.2 Properties of 3-D shapes Question 11 featured a picture of a cube and asked learners to describe the properties of the shape in terms of rolling or gliding. According to the Mathematics CAPS document, Grade 2 and Grade 3 learners should be adept with sorting 3-D shapes corresponding to their properties, such as rolling or gliding (Department of Basic Education, 2011:26, 403). The minimum usage learners had seven (70 per cent) correct answers. The average usage group had a success rate of 60 per cent, while the high usage group had eight (80 per cent) correct answers for Question 11. The data shows that nine conceptual errors were made - some learners answered "no", which indicates a lack of understanding of the question and the properties of 3-D shapes. The data suggests that some learners have to experience the 3-D shapes concretely since 30 per cent of answers were wrong. It is also apparent that most of the learners could answer this question, but the average usage group had slightly less success with this question. 4.6.4.3 Symmetry Question 12 asked learners to draw a line of symmetry on a picture of an arrow. The Mathematics CAPS document states that Grade 2 learners should be adept with recognising and drawing lines of symmetry on 2-D shapes (Department of Basic Education, 2011:27). By term two of Grade 3, learners should be able to identify the line of symmetry through folding the paper and reflection (Department of Basic Education, 2011:404). The minimum and average usage learners had seven (70 per cent) correct answers. The high usage group had a success rate of 80 per cent for Question 12. The data indicates that three Computational/Careless errors were made, 104 where learners drew the line off-centre. Five conceptual errors were made, where learners drew no line and did not know what a line of symmetry meant. It is clear that learners had more success in this question since only 26.6 per cent of answers were wrong. The high usage group had a slightly higher success rate with this question. 4.6.5 Measurement 4.6.5.1 Time Question 13 featured an analogue clock showing the time as half past four and learners had to say what time it was. According to the Mathematics CAPS document, Grade 2 and Grade 3 learners should be able to tell the analogue time in hours, minutes, half past, quarter past and quarter to (Department of Basic Education, 2011:29, 405). The minimum usage learners had seven (70 per cent) correct answers, while the average usage group had nine (90 per cent). The high usage group had a success rate of 100 per cent for Question 13. The data indicates that three Computational/Careless errors were made, where learners answered hastily and wrote down half past three. Only one conceptual error was made, where the learner wrote down an irrelevant time reading. It is evident that learners had more success in this question since only 13.3 per cent of answers were wrong. The high usage group had a slightly higher success rate with this question. 4.6.5.2 Mass Question 14 asked learners to identify and circle two instruments that are used for measuring mass. The Mathematics CAPS document states that Grade 2 learners should be adept with measuring, sorting and recording mass by using informal measuring instruments and a bathroom scale (Department of Basic Education, 2011:31). By term 2, Grade 3 learners should be able to use bathroom and kitchen scales for measuring mass (Department of Basic Education, 2011:409). All three groups had three (30 per cent) correct answers for Question 14. The data shows that twenty-one conceptual errors were made - most of the learners circled only one of the scales, while the others circled instruments used to measure length. The data suggests that learners have to work more concretely with mass measurement since 73.3 per cent of answers were wrong. It is therefore apparent that all groups struggled with this question. 105 4.6.6 Data handling 4.6.6.1 Analysis of data Question 15 had learners analyse a bar graph and identify the two children who read between five and ten books. According to the Mathematics CAPS document, Grade 2 learners should be able to answer questions about data in pictographs, while Grade 3 learners should be able to analyse bar graphs as well (Department of Basic Education, 2011:35, 413). The Grade 2 and 3 teachers confirmed that learners were introduced to bar graphs in Grade 2, and Grade 3 teachers practised bar graph analysis

frequently in terms 1 and 2. The minimum usage learners had three (30 per cent) correct answers. The average and high usage groups had a success rate of only 10 per cent for Question 9. The data indicates that twenty-five conceptual errors were made. Most of the learners only mentioned one of the children who read between five and ten books or only had one correct name listed alongside an incorrect one. It is evident that learners have to work hard on reading and analysing data with insight since 83.3 per cent of answers were wrong. The minimum usage group had a slightly higher success rate with this question but still struggled immensely. 4.6.7 Total impact on cognitive development The totals for each participant were calculated out of fifteen and used to determine the cognitive development of the three groups. The minimum usage group had a mean of 52 per cent in total, while the average and high usage groups had a mean of 51.3 per cent and 46.7 per cent respectively. The overall mode of the minimum usage group was eleven, while the average and high usage groups had a mean of 5 and 4, respectively. The variance for the minimum, average and high usage groups are 7.76, 11.81, and 8.2 respectively - which indicates a large varying degree of dispersion between the responses within the groups, where the average usage learners' ratings are the least similar overall and have the most outliers. The standard deviation reflects the large, varied dispersion between the minimum, average and high usage groups, which are 2.76, 3.43, and 2.86, respectively. It is evident that both the minimum and average learners performed slightly better on their cognitive development test when compared to the high usage group overall. The number of errors made by the three groups was 71, 73, and 80 respectively - which is a clear indication that online teaching and a lack of in-person teaching have impacted the cognitive development of these learners and shows that they are not performing as they should at Grade 3 level. Figure 6: ANOVA test for cognitive development ANOVA was calculated for the three groups to determine if the data is statistically significant at $p < 0.05$ to reject or accept the null hypothesis. The f-ratio was calculated at 0.18 and the p-value is 0.83, therefore, the result is insignificant at $p < 0.05$ and indicates strong evidence for the null hypothesis. However, the data clearly shows that there is a severe impact on the cognitive development of the learners in the three groups, even though the levels of device usage had no significant impact. The Grade 3 learners have not mastered the skills for Grade 2 and evidently are not performing as expected in Grade 3. 4.7 Summary This chapter presented the analysis of the data from the three questionnaires, namely the screen-time, Social Development and Cognitive Development questionnaires. The analysis of the data provided answers to the five research questions, which enables the researcher to answer the main research question and address the hypothesis. The data was collected from fifty-seven respondents, which was then refined to 10 per device usage level. The time spent by Grade 2 (Grade 3 in 2022) learners on the different electronic devices was analysed first and the data revealed a 41.6 per cent increase in total daily screen time from before the pandemic to amid the pandemic. Before the pandemic, the learners spent an average of 3.6 hours daily on electronic devices. In comparison, learners spent an average of five hours daily on electronic devices. The following section discussed the levels of electronic device usage by learners during the COVID-19 pandemic. Learners who used electronic devices for up to two hours daily, were categorised as minimum usage. Responses from parents indicated that sixteen learners fall into the minimum usage category. The average electronic device usage group referred to learners who spend between two to six6 hours on these devices and twenty learners fell into this category. Learners who used electronic devices for more than six hours daily, were categorised as high usage learners. Responses from parents indicated that twenty-one learners fell into this group. The section that followed focused on the impact of different levels of electronic device usage on the social development of learners. Each question was analysed individually and the section concluded with the total impact of electronic device usage on social development. The total for the social development ratings by the Grade 3 teachers for each group of ten learners was calculated and the minimum usage group showed the most progress in social development with a group average of 72 per cent. The average and high usage groups had averages of 55 per cent and 52 per cent respectively for social development, which is considerably less than the minimum usage group. 108 However, the ANOVA had a p-value of 0.077 indicates that the impact of the levels of electronic device usage on the social development of Grade 2 (Grade 3 in 2022) is not statistically significant and suggests strong evidence for the null hypothesis. The impact of different levels of electronic device usage on the cognitive development of learners was analysed next. The mathematical errors made by the participants were categorised as Computational/Careless errors and conceptual errors. Only 50.2 per cent of answers were correct in total for the mathematics achievement test, while Computational/Careless errors formed 27.3 per cent of the possible total, and conceptual errors made up the final 22.4 per cent. The data was analysed per question and finally as a total impact on cognitive development. The average score for the minimum usage group was 52 per cent, followed by the average and high usage groups with scores of 51.3 per cent and 46.7 per cent respectively. However, the ANOVA had a p-value of 0.83, which indicates that the impact of the levels of electronic device usage on the cognitive development of Grade 2 (Grade 3 in 2022) is not statistically significant and suggests strong evidence for the null hypothesis. Chapter 5 will discuss the research findings and conclusions drawn by the researcher, as well as the study's limitations. CHAPTER 5: CONCLUSIONS AND IMPLICATIONS 5.1 Introduction This final chapter will present and explain the conclusions drawn from the study and summarise the answers to the research questions and hypotheses. The first section will summarise the key findings from the study and provide answers to the research questions and hypotheses. The following section will present the research outputs and main contributions of the study, while also discussing the study in relation to the Albert Bandura's Social Cognitive theory of Albert Bandura, and how these findings can be applied in reality. The next section will discuss the limitations and shortcomings of the study. Finally, recommendations for future research will be made based on the limitations of the study. The chapter will conclude with a summary of the content. 5.2 Key findings from the study This study aimed to explore the impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development. This section addresses the key findings from the study for each one of the research aims and questions. 5.2.1 The amount of time spent by Grade 2 learners on electronic devices before the pandemic The first study aim was to establish the amount of time that Grade 2 learners spent on electronic devices before the pandemic. The electronic devices included televisions, MP3 players, cell phones, tablets, video game consoles, and computers. The data was collected from fifty-seven parents, who reported on the time that the learners spent on electronic devices before the pandemic. The total daily screen time of these learners added up to 198 hours. Some learners spent up to ten hours daily on electronic devices, while the group average was 3.6 hours daily. Television viewing and cell phone usage took up the majority of hours that learners spent on electronic devices daily before the pandemic. Learners watched up to five hours of television daily, as well as spent five hours daily on cell phones. The daily average for the group was 1.89 hours and 1.39 hours for television viewing and cell phone usage, respectively. Parents also reported that thirty-nine learners used electronic devices for educational purposes before the pandemic, which amounted to 76.5 hours daily for the group. Parents also indicated that all of them are engaged with electronic devices, together with the learners, which was a total of 101 hours daily for the group and an average of 1.83 hours per learner. 5.2.2 The amount of time spent by Grade 2 learners on electronic devices during the pandemic The second study aim was to establish the amount of time that Grade 2 learners spent on electronic devices amid the COVID-19 pandemic. The data collected from the fifty-seven parents amounted to a total daily screen time of 280.5 hours during the pandemic, which indicates an increase of 41.6 per cent in daily screen time. During the pandemic, some learners spent up to 18 hours daily on electronic devices, while the group average was 5 hours daily. Television viewing increased by 37.3 per cent during the pandemic, while cell phone usage increased with 41.5 per cent. Learners watched more than 6 hours of television daily, as well as spent more than six hours 110 daily on cell phones. The daily average for the group was 2.5 hours and 1.5 hours for television viewing and cell phone usage respectively during the pandemic. Parents also indicated that all of the learners used electronic devices for educational purposes during the pandemic, which amounted to 118 hours daily for the group and an increase of 54.2 per cent. The amount of time that parents were engaged with electronic devices, together with the learners, increased by 36.7 per cent, which totalled 139 hours daily for the group and an average of 2.43 hours per learner. 5.2.3 The levels of electronic device usage by Grade 2 learners The third study aim was to categorise learners into different levels of electronic device usage (minimal usage = one to two hours daily, average usage = three to five hours daily, high usage = 6+ hours daily). The responses from parents indicated that sixteen learners fell into the minimal usage category and accounted for 21.5 hours (7.66 per cent) of the total daily screen time from the Screen time Questionnaire. The data from the questionnaire indicated that twenty learners could be categorised as average electronic device usage and accounted for 71 hours (25.3 per cent) of the total daily screen time. The high electronic device usage group included the remaining twenty- one learners, who accounted for 188 hours (67.02 per cent) of the total daily screen time. The high usage group had a shocking average daily screen time of 8.95 hours. Purposive random sampling was implemented to select ten learners per group to participate in the remaining two questionnaires. 5.2.4 The impact of the different levels of electronic device usage on the social development of Grade 2 learners The fourth study aim was to evaluate the impact of different levels of electronic device usage on the social development of learners. The Grade 2 (Grade 3 in 2022) learners' Grade 3 teachers participated in the Social Development Questionnaire and rated the social development of learners on a scale of 1 (Poor) to 5 (Excellent). The teachers could also add additional qualitative comments regarding the social development of learners with the semi-closed ended questions. The main categories of social development were social interaction with peers and parents, social play, and individual social skills. All of these social development skills are normally developed by age eight (Grade 2) and these learners were all in Grade 3 at the time of participation (Kid Central, 2018:1). The data collected from the Social Development Questionnaire indicated that the minimum usage group had an average rating of 3.6 (72 per cent) for overall social development, while the average and high usage groups had an average score of 2.8 (55 per cent) and 2.6 (52 per cent), respectively. The minimum usage group had the highest rating of 5 (Excellent), while the average and high usage groups had a mode of 3 (Good) and 1 (Poor), respectively. The variance for the minimum, average and high usage groups were 1.09, 0.52, and 1.02, respectively - which indicates a varying degree of dispersion between the responses within the group, where the average usage learners' ratings are the most similar overall. The qualitative data supported the quantitative data in describing the underdeveloped social skills of the learners. The teachers noted that some learners average and high usage learners were not socialising with peers and were very shy. The average and high usage learners were also noted to be very dependent on their parents and had parents who did everything for them. The teachers remarked that some of the average and high usage learners did not participate in fantasy play and others struggled to play with other children when making up their own games and rules - which often led to fighting. In terms of individual social skills, the average and high usage learners were aware of their academic performance, but no effort was put in to improve. Some of the average and high usage learners did not display empathy or remorse and struggled with identifying emotions of others. The teachers also noted that all three groups had learners who did not participate in any sports and did not cope well with losing. The qualitative data therefore indicates that the average and high usage learners had more challenges with social development than the minimum usage group. 5.2.5 The impact of the different levels of electronic device usage on the cognitive development of Grade 2 learners The fifth study aim was to evaluate the impact of different levels of electronic device usage on the cognitive development of learners. The learners participated in a mathematics achievement test (Cognitive Development Questionnaire), which had questions that covered the five main categories, as stated in the Curriculum and Assessment Policy Statement (CAPS) for Basic Education. These categories are Numbers, Operations, and Relationships; Patterns, Functions, and Algebra; Space 112 and Shape; Measurement; and Data Handling. Most of the questions formed part of the Grade 2 curriculum and all of these areas are covered by term two of Grade 3. The two main types of mathematical errors were also identified, and mistakes made by learners were categorised accordingly, namely Computational/Careless errors and conceptual errors. The data from the Cognitive Development Questionnaire indicated that 123 errors wer Computational/Careless (27.3 per cent of answers) and 101 errors were conceptual (22.4 per cent of answers). The remaining 50.2 per cent of answers were correct. This is a clear indication that the learners

struggled with understanding the mathematical concepts and reading with insight and made careless mistakes when completing calculations, even though most of the questions covered Grade 2 work (Lake, 2016:4). The total for each participant was calculated out of fifteen, to determine the cognitive development of the three groups. The average scores of the minimum, average and high usage groups were 52 per cent (71 errors), 51.3 per cent (73 errors), and 46.4 per cent (80 errors), respectively. The overall modes for the minimum, average and high usage groups were 11, 5, and 4 out of 15, respectively. The variance for the minimum, average and high usage groups were 7.76, 11.81, and 8.2, respectively. This indicated a very large varying degree of dispersion between the responses within the groups. It is evident that the minimum and average usage groups fared slightly better than the high usage group in the mathematics achievement test, even though all three groups made numerous errors in their calculations, based on work that was mostly covered in Grade 2 and the learners were not performing well on Grade 3 level yet. 5.2.6 The impact of electronic devices during the COVID-19 pandemic on Grade 2 learners' socio-cognitive development The main question and hypothesis for the study was to determine if electronic device usage by Grade 2 learners during the COVID-19 pandemic had an impact on their socio-cognitive development. The Social and Cognitive Development Questionnaires were both subjected to ANOVA to determine if the data was statistically significant at $p > 0.05$ to reject or accept the null hypothesis. The f-ratio for the Social Development Questionnaire was calculated as 2.81, which points to a higher variation between the means of the groups than what could be seen by chance. The p-value is 0.077, 113 therefore, the result is not statistically significant at < 0.05 and indicates strong evidence for the null hypothesis. However, the data clearly shows that there is a definite impact on the social development of learners, where the minimum usage group demonstrated the most progress in social skills development of eight-year-olds. The f-ratio for the Cognitive Development Questionnaire was calculated as 0.18, while the p-value was 0.83. The result is, therefore, not statistically significant at $p < 0.05$ and also indicates strong evidence for the null hypothesis. However, the data clearly indicates that cognitive development in terms of mathematics is impacted immensely, since the learners were only able to answer 50.2 per cent of the questions correctly overall. It is apparent that the learners have yet to master the mathematical cognitive development skills of Grade 2 and are underperforming in Grade 3. 5.3 Research outputs and main contributions of the study This study addressed the fact that previous studies mainly outside of South Africa have explored the numerous implications of electronic device usage on the development of learners. These studies showed that the socio-cognitive development of learners may be impacted negatively. The COVID-19 pandemic has possibly increased media exposure of learners due to quarantine at home and online learning. It was therefore necessary to study the impact of electronic devices on the socio-cognitive development of Grade 2 (Grade 3 in 2022) learners in South Africa. The study indicated that there is an impact related to the levels of electronic device usage by learners on their socio-cognitive development, even though the results are not considered statistically significant and support the null hypothesis. In terms of social development, the minimum, average and high usage groups scored 72, 55, and 52 per cent respectively - which indicates that the minimum usage group demonstrated the most progress in the social development skills of eight-year-olds. In terms of cognitive development, the minimum, average and high usage groups scored 52, 51.3 and 46.4 per cent respectively in the mathematics achievement test. It is important to note that the mathematics sums were mostly taken from the Grade 2 CAPS, up until term two of Grade 3 - which indicates that all groups of learners are experiencing numerous negative implications with their mathematical calculations. It is also noteworthy that online learning and a lack of face-to-face classroom teaching play an fundamental role in the delay of the socio-cognitive development of learners. This study specifically addressed three gaps in existing research. The first gap was the lack of studies about the impact of electronic devices on the socio-cognitive development of learners in South Africa. Previous studies were done in Singapore, Saudi Arabia, North America, UK, and Australia, to name a few (Tung, 2016:1; Al Sagr & Al Sagr, 2020:4; Marsh et al., 2020:284). This study specifically addressed the impact of electronic devices on the social and cognitive development of learners in South Africa, with a focus on learners in Cradock in the Eastern Cape. The second gap in the existing research was the lack of studies about the impact of electronic devices on the socio-cognitive development of Grade 2 learners (Grade 3 in 2022), who are eight and nine-year-olds. Previous studies focused on children younger than two, under five, aged six to seven, nine to eleven and learners older than twelve (Gottschalk, 2019:13; Kaur et al., 2019:784; Lin, 2019:119; Tumbokon, 2020:1). This study specifically focused on learners who were in Grade 2 in 2021, and who were in Grade 3 in 2022 when the data was collected. These learners are all between eight and nine years of age. The socio-cognitive development skills of eight-year-olds and Grade 2 mathematics were the foundation for the questions in the related questionnaires. The third gap is the impact of the COVID 19 pandemic on the amount of electronic device usage by learners, which is a very recent event. One South African study noted that the COVID 19 pandemic has led to excessive screen time, however, this study did not mention how much screen time has increased or what devices are used (Chetty et al., 2020:1). Some studies have been done in North America, UK, Germany, India, and China. All of these studies mentioned an increase in electronic device usage and suggested that various aspects of childhood development may be impacted negatively (Wiederhold, 2020:359; Wunsch et al., 2021:10; Dray, 2020:1; Dutta et al., 2020:2; Xiang et al., 2020:531). This study specifically analysed the different electronic devices that learners use and compared the screen time of each device before and during the pandemic. This enabled the researcher to calculate the increase in screen time amid the COVID-19 pandemic. The SCT was the framework for the study, which is grounded in social observational learning and cognitive processing (Schunk & DiBenedetto, 2020:1). This theory was applied to help determine how the usage of electronic devices affected the socio- cognitive development of Grade 2 learners (Grade 3 in 2022), on the basis that children learn in the context of social relationships and modelled behaviour (Kara, 2018:102). The results from the study indicated that the lack of in-person teaching, social interaction and heightened screen time amid the pandemic impacted the socio- cognitive development of learners. The cognitive development of the learners was impacted the most, which is evident in the scores of the groups in the mathematics achievement test. The data suggests strong evidence that social classroom learning is critical for the socio-cognitive development of learners and that the pandemic impacted these developmental skills negatively. Therefore, this study supports Albert Bandura's Social Cognitive Theory of and its relevance in education. The findings of this study can be applied in the real world and will benefit the learners, parents, teachers and the Basic Department of Education. The parents of the learners will gain insight into the severity of the socio-cognitive delays that their children face. Parents are the teachers at home and can research activities to do with their children to improve the social and cognitive skills that are not yet progressing as expected for their age. Parents can also directly teach and model social skills such as sharing, problem-solving, negotiating, and compromising. The teachers can plan for interventions and directly teach social and cognitive skills. The teachers can do more revision of Grade 2 mathematics concepts in concrete and semi-concrete activities, which can help learners to gain a better understanding of those concepts that are the foundation for the Grade 3 mathematical calculations. These mathematics activities can be done in groups to encourage social interaction and learning, which enables learners to construct their own knowledge and learn from peers. The teachers can also include more group activities when teaching new concepts and demonstrations. Social skills like describing emotions, demonstrating empathy, and group cooperation can be modelled in the classroom and practised in groups. The DBE can inform all South African schools of the impact of the COVID-19 pandemic and increased electronic device usage on the socio-cognitive development of learners. The DBE should formulate an intervention plan or a curriculum enrichment programme, which specifically focuses on improving the socio-cognitive skills of all learners. This will support teachers in preparing learners for becoming successful and holistically functional 21st century members of society. 5.4 Limitations and shortcomings of the study This study had a few limitations and shortcomings. The first limitation was the lapse of time since the conceptualisation of the first chapter and gaining ethical clearance for the project. The research was intended to focus on the Grade 2 learners and their socio-cognitive development. These learners missed approximately five months of face-to-face teaching in their Grade 1 year. However, ethical clearance was granted by the end of 2021, and by that time, the literature review and methodology chapters had not yet been completed. The data collection took place in May 2022, by which time the learners were in Grade 3. The Social Development Questionnaire still focused on the skills of eight-year-olds, while the cognitive development questionnaires contained mostly mathematical sums and concepts from Grade 2 and a few calculations taught to learners by term two of Grade 3. The lapse in time may also have influenced the answers given by parents regarding the electronic device usage by the learners, since more than eighteen months have passed since the National Lockdown in South Africa. The second limitation was the overall sample sizes for the project. The Screen time Questionnaire collected 57 valid responses from parents, out of the 108 possible responses. These 57 responses reflected the population of the town and all races were represented. The sampling size for the minimum, average and high usage groups were ten learners per group. This sample size appeared to be insufficient for ANOVA and the differing variances in the groups reflected the underlying reasons why the effect of different levels of electronic device usage on the socio-cognitive development of learners was statistically insignificant and supported the null hypotheses. This could have been avoided if the researcher had allowed all of the fifty-seven learners to participate in the social and cognitive questionnaires and selected the ten learners per group who had the most similar responses. This selection would have lessened the variance between the learners within the groups. The last limitation was the social desirability of answers given by the parents and the teachers. Both the teachers and parents were encouraged to answer the questionnaires honestly, since it was guaranteed that the names of the learners would be discussed outside of the study. Parents and teachers may have felt inclined to soften responses, for fear of what the researcher may think of the learners and their social development and screen time behaviours. The researcher could address this limitation by following up on these questionnaires with adapted questions for their age and developmental level when the learners progress to the next grade and have new teachers. 5.5 Recommendations for future research This research topic and its limitations experienced in the study offers a few recommendations for future research. The time lapse limitation can be remedied and improved upon by doing a longitudinal study on the participants. The socio-cognitive development and screen time behaviours of these learners can be recorded yearly until these learners complete high school. This research will then track the socio- cognitive development of the learners and indicate whether they overcome the delays in their socio-cognitive development or if they remain underdeveloped in socio- cognitive skills, according to their ages and stages of development. The second recommendation would be to sample data from a much larger population than one grade group at one school. All of the schools in a town could be invited to participate, or even all schools in a province. This will enable the researcher to generalise the findings to the population of the country with ease. The research could even go as far as including schools from all nine provinces and comparing the data between provinces, to determine if the impact of electronic device usage amid the COVID-19 pandemic on the socio-cognitive development varies between provinces or the various school communities and suburbs. This research will then inform the DBE of the nation-wide impact of electronic device usage on the socio-cognitive development of learners. The third research recommendation is for the learners self-report on their electronic device usage behaviours and socio-cognitive development. The questionnaires could be created in such a way that the choices made by the learners reflect their development in the socio-cognitive area, by testing the skills relevant to their age and developmental stage. This will eliminate the social desirability of answers from parents and teachers. However, the learners may also try to answer in a manner that they think is expected of them. The fourth suggestion is to assess the impact of electronic device usage during the COVID-19 pandemic on the emotional and physical development of learners. This research could inform parents, teachers and the DBE of the emotional and physical developmental delays that learners face. This future research could then be viewed in conjunction with the conclusions from this study and could then be used to form a holistic representation of all areas of childhood development impacted by electronic device usage during the pandemic. Finally, future research could take an in-depth look at the impact of online learning amid of the COVID-19 pandemic on the scholastic performance of learners. This study recognised that online teaching formed part of the delays in development. Future

studies could focus on how great the impact of online learning is on all subjects in the Foundation Phase (Home Language, First Additional Language, Mathematics, and Life Skills) and suggest interventions to address these learning gaps. This research will help teachers to easily identify the gaps in learning and enable them to support learners in constructing and improving the necessary knowledge to bridge the gaps. 5.6 Summary Chapter 5 presented the conclusions and implications from the study. The key findings were discussed first, which began with the amount of time spent by learners before and during the COVID-19 pandemic on electronic devices. This was followed by a discussion about the levels of device usage by learners and how many Grade 2 learners (Grade 3 in 2022) fell into the minimum, average and high electronic device usage categories. The impact of the levels of electronic device usage on the social and cognitive development of the learners was first discussed separately and it confirmed the null hypothesis of the impact of the different levels of electronic device usage on the socio-cognitive development of learners. The research outputs and main contributions were presented next, which included how the research question was answered, which gaps in existing literature were addressed, how the study confirmed the relevance of Mandura's Social Cognitive Theory of Albert Bandura, and how these findings could be applied in the real world. The limitations and shortcomings of the study were discussed next, followed by recommendations for future research, based on the limitations and shortcomings. Chapter 5 concluded with a summary of the content presented in the chapter. The final section of this dissertation lists all the references used in the study. References Adolt-Silva, K., 2021. 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Appendix 2 4 6 8 11 12 13 14 15 16 17 18 19 20 22 23 24 25 26 28 29 30 31 32 33 34 35 39 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 71 72 73 74 75 77 78 79 80 82 87 88 89 90 91 94 96 97 98 100 103 106 107 109 111 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136