Comparison of Prompting Procedures: Assessing the Efficacy of Video Modelling and Text Based Prompting to Teach Technology Skills to an Elderly Population

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Abstract

With the rapid advancement of technology, older adults are falling further behind and thus contributing to the growing “grey” digital divide. Information and Communication Technology (ICT) is well documented to reduce feelings of social isolation and loneliness in older adults; however, the most effective way to teach technology skills in these populations is still debated. To investigate the most effective and efficient way to teach technology skills to older adults, one participant aged 72 years old was recruited to learn three iPad-based tasks: sending an email, downloading an application from the AppStore, and video calling (FaceTime). These tasks were taught using techniques based in Applied Behaviour Analysis (ABA). The effects of text-based prompts and video modelling with accompanying picture prompts on skill acquisition were assessed via a three-phase alternating treatment experimental design with baseline probes and a final best intervention phase. Results show that video modelling with accompanying picture prompts was more effective than text-based prompts for technology-based skill acquisition in older adults. Potential limitations of the present study and future research are discussed.

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Table of Contents

List of Figures

List of Tables

Technology and Elderly Populations

As technology rapidly advances, a digital technology divide has appeared in which younger adults are far more likely to use technology than older adults (Dickinson et al., 2005; Morris, 2007; Olson et al., 2011). While elderly populations, sometimes known as "silver surfers", are present online, they make up a very small proportion of technology users (Gell et al., 2015; Morrell et al., 2000; Morris, 2007; Olson et al., 2011).

Literature Review

The "Grey Divide"

Technology is becoming increasingly difficult to avoid for the average person (Huxhold et al., 2020; Slegers et al., 2008). In just the last 40 years alone, technology has advanced from large bulky mainframe computers to handheld devices that can wirelessly connect the user to the internet (De Kare-Silver, 2011). This rapid advancement has led to technology becoming engrained in every facet of life (Huxhold et al., 2020; Namazi & McClintic, 2003; Warren-Peace et al., 2008). Technology is now used for everything from online shopping to turning lights on and off via Google Home. Society is now more reliant on technology than ever before (Huxhold et al., 2020; Namazi & McClintic, 2003), with individuals being forced to use digital touch screens to order fast food, pay for parking, and confirm their doctors' appointment at reception. These automated technological advances can be very difficult to use if you do not have any prior experience or are tech "illiterate" (Blažič & Blažič, 2020; Krajnc, 2012; Warren-Peace et al., 2008). Digital literacy can be defined as being able to perform tasks on a digital device and access knowledge and information which is "embedded in a digital environment" (Blažič & Blažič, 2020, p. 260).

Elderly populations are making up a growing percentage of the population, and while the number of "silver surfers" is increasing, there continues to be a digital divide (Berkowsky et al., 2013; Blažič & Blažič, 2020; Charness & Boot, 2009; Morris, 2007; Mubarak & Nycyk, 2017). The grey divide is a term used to describe the differences in technology use, both frequency and breadth, between younger and older populations (Morris, 2007; Olson et al., 2011).

The definition of elderly populations is reported differently among the literature, with some authors referring to adults older than 60 years and others older than 70 years. However, the vast majority of literature defines elderly as 65 years and older. This is the definition that this present study will use unless otherwise specified. Elderly aged 65 years and older (those born before 1956) grew up without computers, cell phones, and other technology which is now considered essential to life in the 21st century (Heaggans, 2012). In a very short period of time, technology has changed from something that only large businesses and wealthy individuals could afford, to something that nearly every house utilises on a daily basis.

Many academic papers discussing the concept of a grey divide were written in the early 2000s to 2010s. However, this concept is still an area of focus for some researchers. The grey divide was discussed in 2017 by Mubarak and Nycyk and again in 2020 by Blažič and Blažič, who both noted that it was still very much present in the late 2010s (Blažič & Blažič, 2020; Mubarak & Nycyk, 2017).

Use of Technology Based on Age

While the use of technology by the 65 years and older group is significantly less than other age groups, it is slowly increasing from the low starting point (Charness & Boot, 2009; Gell et al., 2015; Olson et al., 2011). In 2008, 89 percent of individuals aged between 18 and 29 years used the internet, compared to 33 percent of elderly adults aged 65 years and older (Olson et al., 2011). This level has increased slightly to 42.7 percent in 2011 (Olson et al., 2011). When the 65 and older age group is defined further into separate age groups it is widely reported that use of technology drops significantly with increase in age, with 50 percent of 65- to 74-year-olds reported using the internet in the last month compared to only 10 percent of those aged 90 plus (Olson et al., 2011). In a study based in America, the number of adults over the age of 60 years using technology had only increased slightly between 2011 and 2016. In 2011, only 60.2 percent of older adults reported using the internet compared to 66.4 percent in 2016 (Yoon et al., 2021). This study also confirmed the trends discussed in Olsen and colleagues' 2011 paper which show that younger older adults use the internet significantly more than old older adults (Yoon et al., 2021).

Though the number of older adults using technology has increased, it has not yet closed the gap of the "grey divide". However, this lag is to be expected as technology advances so rapidly and older adult education on technology use stays stagnant (Charness & Boot, 2009). The digital divide is thought to not arise due to frailty or age, but due to the digital illiteracy amongst elderly individuals and the rapidly advancing pace of technology (Blažič & Blažič, 2020).

The idea of the digital rich and digital poor was discussed by Hill in 2015. Similarly to social and economic phenomena, those with proficient digital technology skills or digitally rich individuals tend to keep up with the pace of technology and continue to get richer, whereas those who lack digital skills and knowledge continue to fall behind when using technology. This idea of a Matthew effect (the rich getting richer and the poor getting poorer) is another possible answer to why the digital divide continues to grow even as access to communication technology increases (Hill et al., 2015). Conversely, some studies expect that the up-and-coming older adults may have less trouble using technology as they will have more experience with the internet (Boulton-Lewis, 2010). This may help in closing the digital divide.

The breadth of use of technology also changes with age (Olson et al., 2011). The term information and communication technology (ICT) refers to all communication technology which broadly includes computers and the internet, tablets, telephones (both landline and cellular phones), radio, and television (Elliot et al., 2014). While most studies on the topic of elderly and technology examine if someone is a tech user or not, a study by Olson investigated further and examined the frequency of use and the breadth of the type of technology most used. Although the use of older technologies such as landlines, radio, and television are common amongst elderly respondents, the use of newer technologies such as computers and cell phones are more widely utilised by younger respondents (Olson et al., 2011).

Email, SMSing, and video calling are commonly reported ICTs used by elderly individuals with 47 percent of elderly participants reporting that they emailed, texted, or used the internet in the last month (Gell et al., 2015). Shopping and online banking are often met with security fears; however, telebanking is reported as a common use of technology among older adults (Carpenter & Buday, 2007). When using the internet, the top favourite uses for older adults included emailing, planning future travel, and researching health-related information (Gell et al., 2015; Marston et al., 2019; Morrell et al., 2000; Olson et al., 2011). Brain training applications seem to be popular amongst elderly adults, though the evidence supporting their benefits are limited (Boulton-Lewis, 2010).

The frequency of use between age groups also shows discrepancies (Olson et al., 2011). The majority of older adults reported using the internet for one to five hours per week, whereas younger adults reported using the internet for 15 or more hours per week (Olson et al., 2011). This could be explained by younger adults using the internet and computers in their careers more than elderly persons who are more likely to be retired. An interesting finding in Olsen et al. showed that not only do younger adults use the internet more in an average week, but they have also been using the technology for more years than their elderly counterparts (Olson et al., 2011). Adults aged 65 and over grew up in a time before ICT classes existed in schools, and their careers most likely did not require extensive use of computers (Morris, 2007).

Older adults have been found to be slower to adopt new technology than their younger peers (Charness & Boot, 2009; Olson et al., 2011). Older adults are also more likely to make the same or similar mistakes when using technology (Warren-Peace et al., 2008). Prior experience seems to help predict the success that an elderly person has when learning to use new technology (Warren-Peace et al., 2008). When new technology skills were taught to a 59-year-old with little prior experience and to an 83-year-old with some experience with technology, the older adult demonstrated quicker learning and retained this knowledge at future sessions (Warren-Peace et al., 2008). However, conflicting results came from a study conducted in 2009 by Charness and Boot, who concluded that older adults took twice as long to learn new technology than younger adults regardless of their prior experience.

Importance of Technology Skills

The importance of technology skills is ever increasing as technology advances at a rapid pace, societies reliance on technology increases, and the population of elderly individuals increases worldwide (Charness & Boot, 2009; Charness & Holley, 2004; Huxhold et al., 2020; Morris, 2007; Namazi & McClintic, 2003; Warren-Peace et al., 2008). The percentage of the elderly population is increasing in New Zealand, with New Zealand's elderly population expected to make up 24-33 percent of the total population by 2068 (MacPherson, 2016). Similar rates of growth are expected around the world as birth rates drop and individuals live longer due to advances in healthcare and better living conditions (Kramkowska et al., 2019; Lee, 2015; Rahimi et al., 2016). The older adult segment is the fastest-growing portion of the population (MacPherson, 2016; Morris & Ballard, 2003), which means that it is important that technological skills can be taught effectively and efficiently. While the upcoming elderly adults may have grown up with technology, the rapid advancement of the types of technology produced means that finding an efficient and effective way to teach older adults will remain an important and relevant area of study. Due to the ongoing COVID-19 pandemic, an effective method of teaching technology skills is very important. Ongoing lockdowns have resulted in an increase in social isolation and loneliness (Briguglio et al., 2020). Technology use opens a world with near-endless possibilities. ICTs, particularly the internet, allow the user to make social connections and meaningful relationships (Blaschke et al., 2009; Carpenter & Buday, 2007; Chopik, 2016; Heo et al., 2015; Morris, 2007; Namazi & McClintic, 2003).

The internet provides the user with near-limitless information and games. Older adults also reported they viewed medical and health-based information online to help them understand conditions and make informed decisions for medications and procedures (Carpenter & Buday, 2007; Gell et al., 2015; Marston et al., 2019; Olson et al., 2011). Older adults have been shown to benefit greatly from the use of online health services, especially if they have an ongoing or chronic condition. However, adoption of these services by older adults is still low (Fox & Connolly, 2018). The fear of scammers and lack of security may account for the lack of technology use in older populations. An important skill required for individuals who use the internet is the ability to discern real information from dishonest information and potential scams (Gatto & Tak, 2008; Hill et al., 2015). Games provide an escape and another opportunity to make connections. Those elderly individuals who use little technology are also more likely to miss out on important announcements as newer technologies are increasingly utilised to spread information for natural disasters and health/pandemic news (Gell et al., 2015).

Benefits of Technology Use

The possibilities of things to do, see, and buy on the internet is nearly endless. Email, instant messaging, video messaging allows the user to make contact with family and friends who they may not be able to see in person due to distance. In addition to making life easier and providing games and activities, the internet has several important benefits that may improve quality of life, especially in older adults (Carpenter & Buday, 2007; Chen & Persson, 2002; Heo et al., 2015; Ihm & Hsieh, 2015; Morrell et al., 2000; Morris, 2007; Szabo et al., 2019; Van De Watering, 2005; Warren-Peace et al., 2008).

Older adults, particularly in retirement homes, have been shown to be particularly vulnerable to social isolation and loneliness. This social isolation and loneliness is associated with a decrease in social networks, mobility, and physical and mental health (Barbosa Neves et al., 2019). Social isolation has been defined broadly as low or nonexistent levels of social support and a decrease in both the quality and quantity of their social ties (Barbosa Neves et al., 2019; Cornwell & Waite, 2009), whereas loneliness is the perceived lack of social ties and associated feelings of abandonment (Barbosa Neves et al., 2019; Perissinotto et al., 2012). Both social isolation and loneliness have a negative impact on physical and mental health. Communication technology can provide meaningful social interactions for individuals, particularly when relatives and friends are geographically distant (Barbosa Neves et al., 2019).

The use of technology is strongly associated with an increase in feelings of belonging. Conversely, too much technology use in an elderly population has also been shown to be associated with increased feelings of over-dependence and emotional attachment to technology devices. This ultimately leads to a decrease in feelings of belonging (Wilson, 2018). Conversely, an increase in time spent on communication technology was also associated with a decrease in loneliness with no reports of “too much” technology time (Hill et al., 2015; Morrell et al., 2000). It is widely reported that an increase in technology use, particularly ICT, has been reported to be associated with significant improvements in feelings of loneliness, depression, and self-esteem (Carpenter & Buday, 2007; Chopik, 2016; Gatto &

Tak, 2008; Heo et al., 2015; Khosravi et al., 2016; Van De Watering, 2005). Varying studies report an increase in independence and the potential to preserve existing independence (Carpenter & Buday, 2007; Morris, 2007).

An increase in self-esteem is also commonly reported with increased technology use (Berkowsky et al., 2013; Blaschke et al., 2009; Gatto & Tak, 2008; Ihm & Hsieh, 2015). These social connections can help to reduce social isolation and feelings of loneliness (Carpenter & Buday, 2007; Chopik, 2016; Gatto & Tak, 2008; Heo et al., 2015; Khosravi et al., 2016; Van De Watering, 2005). Connectedness and increased participation in pop culture are welcome side effects of technology use.

Along with psychological benefits, technology use is also associated with better health and improved alertness (Carpenter & Buday, 2007; Gell et al., 2015). Higher levels of technology use is correlated to users with fewer disabilities (Carpenter & Buday, 2007; Gell et al., 2015), more independence (Carpenter & Buday, 2007; Morris, 2007), fewer chronic illnesses (Chopik, 2016), higher levels of satisfaction (Gatto & Tak, 2008; Heo et al., 2015), and overall better quality of life (Namazi & McClintic, 2003; White et al., 1999). The use of technology may also assist in a slower decrease in cognitive abilities (Van De Watering, 2005), although research in this area shows mixed results (Elliot et al., 2014; Slegers et al., 2008). However, it is important to note that these connections are correlational and not necessarily caused by technology use. Individuals with disabilities most likely use less technology due to impaired ability, rather than the idea that their disability is being caused by their lack of technology use (Gell et al., 2015).

Ageing and Barriers to Technology Use

Despite the well-documented benefits of using technology as an older adult, there are many potential barriers to technology use. These barriers are multicausal. The main barriers fall into three subgroups: physical, psychological (attitudinal and cognitive), and lack of access (Blaschke et al., 2009; Carpenter & Buday, 2007; Charness & Boot, 2009; Charness & Holley, 2004; Gatto & Tak, 2008; Gitlow, 2014; Hill et al., 2015; Hussain et al., 2018; Morrell et al., 2000; Morris, 2007). It is very important to examine these barriers in detail so that potential solutions can be implemented.

Older adults are a heterogeneous population with individuals ranging from fit and healthy to frail and disabled (Lee, 2015; Morris, 2007). Despite this, it is widely accepted that elderliness and ageing come with several challenges. The physical changes associated with ageing include a decline in sight, hearing, dexterity, and motor movements (Carpenter & Buday, 2007; Charness & Holley, 2004; Gitlow, 2014; Morris, 2007; Namazi & McClintic, 2003). As humans age, they are more likely to develop eye-related problems such as cataracts, macular degeneration, and glaucoma; all of which result in a reduction in their visual acuity (Charness & Holley, 2004; Jones & Bayen, 1998). This limited ability to see is associated with a reduction in the amount of time spent using technology amongst elderly adults (Gell et al., 2015). The decline in vision makes it difficult to see small text, non-contrasting web pages, and the position of items on the screen (Charness & Boot, 2009; Namazi & McClintic, 2003). Along with sight, hearing is known to decrease with age with some 85 percent of older adults experiencing some form of hearing loss (Charness & Holley, 2004). Though this poses less of a barrier than a reduction in sight, it is associated with reduced technology use. As ICT devices require you to tap, click, and scroll, a decline in a person's dexterity or motor skills can greatly impact how successfully they can use these devices (Charness & Holley, 2004).

Along with these physical changes, health problems that impact cognitive ability also increase with age (Bishop et al., 2010; Briguglio et al., 2020). Strokes, memory declines from Alzheimer's disease or dementia, and Parkinson's disease are likely to make technology use more difficult. These medical conditions are often accompanied by physical and cognitive changes. Arthritis is thought to affect 62 percent of females and 43.7 percent of males over the age of 65 (Charness & Holley, 2004). The accompanying pain of moving hands and fingers is a further deterrent for technology use. Learning to use new technology can be a difficult and lengthy process. Older adults with memory declines tend to have a difficult time learning and remembering the steps involved (Namazi & McClintic, 2003). This can lengthen the process which may lead to increased levels of frustration, anxiety, and lack of motivation to finish the task (Charness & Boot, 2009; Namazi & McClintic, 2003). Despite lengthening the process of skill acquisition, older adults are capable of learning new skills with some research reporting that with additional time they are able to achieve similar learning outcomes as their younger peers (Boulton-Lewis, 2010; Olson et al., 2011).

Disabilities are known to increase as we age (Bishop et al., 2010; Briguglio et al., 2020; Gell et al., 2015). Older adults with disabilities tend to use technology less than their able-bodied peers (Gell et al., 2015). However, some disabilities are correlated with an increase in technology use. While those with vision, hearing, and dexterity problems are less likely to use technology, those with chronic pain and shortness of breath tend to use technology more (Gell et al., 2015). "Housebound" adults may be able to use technology as an escape and those with pain can utilise different functions (i.e., Google Earth) to see places they may never be able to go to in person (Gell et al., 2015).

Barriers to technology use in elderly populations have been examined thoroughly in recent years. Psychological barriers also present a challenge to those trying to increase technology use in older adults (Charness & Boot, 2009; Hill et al., 2015). Older adults were interviewed about their perceptions of technology. Among the commonly reported barriers to tech use were attitudinal problems such as lack of motivation or interest (Morrell et al., 2000; Morris, 2007), apathy (Namazi & McClintic, 2003), and the idea that technology was too difficult to use (Carpenter & Buday, 2007). An increase in anxiety was also reported in individuals who were forced to use novel technology as a part of their everyday lives. There are a multitude of reasons that new technology is feared which include feeling too old to use technology (Morris, 2007), lack of privacy, and security concerns (Gatto & Tak, 2008; Hill et al., 2015; Hussain et al., 2018; Mitzner et al., 2010; Morris, 2007). Negative associations with new technology are widely reported among elderly populations, however, in a study by Mitzner and colleagues, it was revealed that the positive attitudes of older adults towards technology outweigh the negative attitudes. The discrepancy in the literature may be due to different populations and sample sizes, but further research is needed to examine this.

Older adults reported an increase in anxiety when they were faced with a novel piece of technology. With repeated use, it was reported that this initial apprehension lessened and was replaced with new fears regarding security and privacy (Hill et al., 2015). Security concerns are reported in much of the literature surrounding barriers to technology use in older adults (Gatto & Tak, 2008; Hill et al., 2015; Hussain et al., 2018; Mitzner et al., 2010). Online scammers often prey on older computer illiterate individuals in an attempt to trick them out of their savings. While this fact is commonly known, these scams are still very successful due to their constant adaptation (Gatto & Tak, 2008; Hussain et al., 2018; Mitzner et al., 2010; Morris, 2007).

In addition to barriers regarding the technology user, there are many other barriers related to access to the technology itself. Cost is a major obstacle for many older adults attempting to join tech users (Blaschke et al., 2009; Carpenter & Buday, 2007; Morrell et al., 2000; Morris, 2007). While the cost of a computer or cell phone has reduced immensely over the past years, it is still unobtainable for some retired older adults. In a 2011 study, only 63.2 percent of older adults reported that they had access to a computer (Gell et al., 2015).

Tech developers are always trying to make their products more user friendly and less complex to use. When cell phones were becoming popular, most devices came with a user manual. However, newer phones do not come with a printed user guide. User guides are available for download, but for a tech-illiterate user this is not practical. Most newer technologies build on previous devices, making it harder for someone to use for the first time. This is not to say that younger adults do not have trouble using newer complex technology, however, younger adults are more likely to be tech-savvy and are able to use Google to help solve their problem. This is not likely to be a possibility for someone new to technology.

Overcoming the Barriers

Learning new technology skills is difficult without the additional barriers that older adults have to face. Current research on technology and elderly adults is focused on how to overcome these barriers. Future technology designers need to take older adult's physical, cognitive, and motor skills, as well as their health into account when developing new technology (Boulton-Lewis, 2010; Charness & Boot, 2009; Morris, 2007; Morris & Ballard, 2003; Namazi & McClintic, 2003; Warren-Peace et al., 2008).

To attempt to overcome the reduction in vision, future technology developers could focus on increasing the font, providing the option for higher contrast, increasing the size of the letters on the keyboard, and simplifying the background (Charness & Boot, 2009). Those with vision declines often have difficulty seeing if the contrast is too low. High contrast black and white may be helpful for those individuals (Charness & Boot, 2009). Increasing the size of the cursor on the screen makes it easier to see where you are clicking (Charness & Boot, 2009; Namazi & McClintic, 2003). Fonts over 14 points were reported to be sufficient for older adults. Dark green, blue, and violet font colours should be avoided as these may become more difficult to see due to the ageing and yellowing of the eye (Morris & Ballard, 2003).

To aid in overcoming the barriers from deterioration in dexterity, reducing the sensitivity of the mouse can help if the user's movements are jerky and uncoordinated

(Charness & Boot, 2009; Namazi & McClintic, 2003). Technology that requires minimal scrolling has been found to be easier and more preferred by older technology users (Charness & Boot, 2009). Double-clicking is a vital part of using a computer. This rapid movement can be difficult to achieve with arthritic hands. A potential solution proposed by Namazi and McClintic in 2003 is to click once and then press enter. While this adds another step, it may make using a computer more accessible for an older adult.

However, not all researchers agree that technology should be able to be modified but rather there should be a universal design to promote inclusivity (Mannheim et al., 2019). Due to the widely varying nature of the elderly population, designing technology that is suitable and practical for older adults is difficult. While the majority of research on the inclusion of elderly populations using technology focus on making small changes to ensure the technology is usable, Mannheim and colleagues suggest that this may not be the best idea. Technology designers should instead focus on a universal design that can be used by everyone (Mannheim et al., 2019). Instead of including settings that allow individuals with disabilities or varying needs to change their settings as required, it is suggested that all technology should be of similar designs. The authors emphasise that age is not something to be fixed. The idea of a universal design and less sigma surrounding ageing is a complex issue. While on paper this idea sounds logical, in practice it would be difficult to accomplish. Due to the heterogeneity of the population, one individual may need to have increased brightness and well-differentiated fonts whereas others may need a dimmer screen with no fonts that are dark green, violet, or blue (Morris & Ballard, 2003). It would be far more practical for technology designers to focus on ensuring the new technology can be modified for the individual.

The need to understand the barriers that ageing imposes on learning will help to form effective teaching techniques for older adults. Education courses are often set in places primarily used to educate younger adults. These settings are impractical and often unrealistic. Stairs, distant parking, and insufficient lighting are common complaints in these settings (Morris & Ballard, 2003) The location in which the education takes place has a profound effect on the number of students and the success of their learning (Morris & Ballard, 2003; Morris et al., 1999). Over two studies, one in 1999 and one in 2003, Morris and colleagues conducted interviews with older adults to determine which factors in the environment were important. The accessibility of the location and parking were important to older adults. Other important factors included room temperature (low to mid 20's C), comfortable seating, sufficient lighting, good acoustics, lowered pitch of educators voice, absence of stairs, and proximity of bathroom from the classroom (Morris & Ballard, 2003; Morris et al., 1999).

In addition to changes to the technology, educating older adults on how to use technology and online security will help to reduce the anxiety associated with new technology (Krajnc, 2012). New technology can be especially daunting if you have no prior experience. However, the current ways to teach older adults to use technology are limited to inefficient group classes not catered to elderly students and costly one-on-one training.

Elderly Education

Current Approaches to Teaching Older Adults

The idea that elderly adults are frail is changing. The older adults of the 21st century are likely to be better educated, healthier, and more financially protected (Boulton-Lewis, 2010). Contrary to popular opinion, many older adults are motivated and want to learn (Boulton-Lewis, 2010; Krajnc, 2012; Lee, 2015; Olson et al., 2011). Learning provides many benefits in addition to the acquisition of knowledge. These include increased social connections (Boulton-Lewis, 2010), participation in society (Boulton-Lewis, 2010; Lee, 2015), improved quality of life (Morris & Ballard, 2003), increased ability for adaptation to changes, and increased ability to problem solve (Boulton-Lewis, 2010). Problem solving is an important skill that is linked to “active ageing” and increased life span. A harmful stereotype of elderly students is that they are unable or unwilling to learn (Boulton-Lewis, 2010; Krajnc, 2012; Lee, 2015; Olson et al., 2011). This is false, and many studies have reported that elderly populations are highly motivated to learn. If given appropriate time, elderly students are able to achieve similar results to their younger peers (John, 1981).

The current approaches to teaching older adults remain rooted in group classes and lecture-style courses (John, 1981; Lee, 2015). This approach is not especially effective for older adults who have different learning needs to younger students. However, these groups do have some advantages in that it allows the students to form bonds and meaningful connections and thereby reduce social isolation and feelings of loneliness (Krajnc, 2012).

Education leading to distant goals and advancement in careers is not relevant to older adults who may no longer be working (John, 1981). Education and learning in older adults is driven by interest, curiosity, knowledge acquisition, and keeping an active brain (Boulton-Lewis, 2010; John, 1981; Krajnc, 2012; Phipps et al., 2013). Educational courses targeted towards elderly populations often focus on health, technology, and security. However, these are skills that are deemed important and necessary by professionals (Boulton-Lewis, 2010). Older adults are not often asked what they want to learn. In 2010, Boulton-Lewis conducted a study in which older adults were asked what they were interested in learning about. Responses included new talents, practical skills such as gardening, hobbies, politics, languages, and technology skills such as computer, internet, and email use (Boulton-Lewis, 2010). They were also interested in learning more about genealogy, the early days, travel, biology, geography and more. The biggest goal of older adults is independence (John, 1981).

Learning a new skill can be daunting if you have no prior knowledge. Older adults report feelings of anxiety and apprehension when faced with learning novel skills (Charness

& Boot, 2009). Feeling too old or not being able to learn is a big deterrent in older adults seeking out education (John, 1981; Morris, 2007; Phipps et al., 2013).

In a 2015 paper, Lee discusses older adult education in Taiwan. Similarly to the rest of the world, low birth rates and increases in medical care have led to an ageing population. There is a big push for education and learning at any age. The reduction in births and thus students has resulted in space for targeted adult education (Lee, 2015). The first elderly only education centre opened in 1978, and in 2012 this number had increased to 319 centres. Courses taught between 1978 and 2006 were rooted in classroom lectures with limited and repetitive topics (Lee, 2015).

Recent research has promoted moving away from the idea of teaching older adults through a lecture-based environment and moving towards individualised and targeted courses specific to older adults (Boulton-Lewis, 2010; Lee, 2015; Morris & Ballard, 2003). While novel skills can be taught in a variety of ways, one way to promote skill acquisition is through applied behaviour analysis.

Pachis 2017 Replication

The proposed study is a replication of a 2017 Canadian study that employed a single case experimental design (SCED) (Pachis, 2017). SCEDs require systematic replications to provide external validity to the findings. The current study will build upon this prior study by incorporating new ideas and addressing some limitations of the original study and thus adding to the knowledge base.

Pachis employed an alternating treatments design with an initial baseline phase to assess skill acquisition among three older adults. Techniques based in applied behaviour analysis (ABA) were used to aid in the skill acquisition. These techniques and ABA are discussed further in the following sections. Visual (video), and verbal (written) prompting were used to teach three elderly participants iPad-based tasks. A control condition was employed to assess for learning effects and experimental control. The tasks were broken down into individual steps using a task chain analysis and taught via total task chaining (Pachis, 2017). It was found that both prompting types were effective for teaching internet skills to an elderly population (Pachis, 2017).

Applied Behaviour Analysis and Skill Acquisition

Derived from Behavioural Science, Applied Behaviour Analysis (ABA) is a field within psychology that uses a scientific approach to make meaningful changes to socially significant behaviour. Techniques developed within this field allow researchers to collect and assess quantifiable data. This allows them to determine functional relationships between behaviour and the variables which may be responsible for the behaviour (Cooper et al., 2007). Long-lasting changes to socially significant behaviours have been demonstrated in a wide variety of settings and with a varied population.

ABA is commonly used to aid in skill acquisition in a wide range of populations. A precise definition of the target behaviour and intended interventions or treatments allow for reliable quantification of the data that is collected. This ensures that the effects of an intervention on a behaviour can be accurately and reliably measured. Accurate and precise definitions allow for replication of the research and thus the potential for external validity. The precise definitions also allow for a high level of experimental integrity (Cooper et al., 2007).

ABA and its techniques have been shown to produce meaningful and long-lasting changes to behaviour. For this reason, techniques based in ABA will be utilised to aid in skill acquisition in older adults. The techniques that will be applied in this study include chaining and task analysis, prompting (visual and textual), and modelling.

Chaining and Task Analysis

Chaining has been successfully used to teach skills to a wide range of populations, especially those with special needs (Hur & Osborne, 1993; Jerome et al., 2007; Montalmont, 2018; Rayner, 2011; Shrestha et al., 2013). It allows complex and lengthy tasks to be taught effectively. Chaining involves breaking down the desired behaviour into smaller more manageable discrete responses (Cooper et al., 2007; Smith, 1999). This effectively reduces a complex task into smaller steps that can be taught independently. Before chaining can take place, a task analysis must be completed (Cooper et al., 2007). Task analysis is the process of breaking down the behaviour into sections that can then be chained together. The success of the chaining procedure is more likely if the initial process of task analysis is complete and thorough (Cooper et al., 2007).

A behaviour chain can be taught in three main ways: forward, backwards, and total task chaining (Cooper et al., 2007; Smith, 1999). Forward chaining involves teaching the behaviour chain starting with the initial step, and progressing forwards until all steps have been taught (Cooper et al., 2007; Smith, 1999). Conversely, backwards chaining involves the trainer completing all of the steps and then teaching the last step in the behaviour chain first, progressing backwards until the first step has been taught (Cooper et al., 2007; Smith, 1999). This method allows the learner to experience the reinforcement of the completed task from the first trial (Cooper et al., 2007). Forward chaining does not offer this same advantage. Total-task chaining (TTC) involves teaching every step in the chain during every session. During teaching sessions assistance is given to the learner if required (Cooper et al., 2007).

The best chaining method to utilise for skill acquisition is still debated amongst researchers (Cooper et al., 2007). Studies directly comparing forward, backward, and total-task chaining have reported mixed results. In a 1999 paper by Smith, there were differences in conclusions within the same research. In the first experiment, it was concluded that TTC was inferior to both forward and backward chaining. However, on further assessment, it was decided that the behaviour chains within the complex task were varied in complexity. When a second experiment was conducted with a more uniform difficulty amongst the chains, it was found that TTC and forward chain resulted in fewer errors than backwards chaining (Smith, 1999).

Forward and backward chaining were compared and found to have no differences in terms of effectiveness when teaching corsage skills to mild to moderately disabled individuals (Hur & Osborne, 1993). However, forward chaining was preferred by the trainers as it resulted in less preparation (Hur & Osborne, 1993). Cooper, Heron, and Heward have concluded that overall, one method is not likely to be more successful than the others. TTC is the most "natural" type of chaining, in that the learner is able to experience all parts of the task each time they perform it (McDonnell & Laughlin, 1989). TTC also allows the learner to set their own pace which may be particularly helpful for older adults who require more time to learn novel skills than their younger peers (Charness & Boot, 2009; Olson et al., 2011). TTC may be successful in teaching individuals who have prior knowledge in some components of the task (Cooper et al., 2007), are able to imitate a model (Cooper et al., 2007), and if the task is not overly complicated or lengthy (Cooper et al., 2007; Miltenberger, 2001). This makes TTC an ideal method for teaching older adults technology skills. Older adult learners without disabilities impacting their mobility are likely to be able to perform tapping, swiping, and scrolling motions with their fingers and hands and imitate a model performing a task (Shigematsu et al., 2014). The skills chosen to be researched in this study will include sending an email, video calling, and downloading an application from the AppStore. While technology skills are novel to these populations, the chain of behaviour that make up these tasks are not very long or difficult.

Chaining allows for the level of competency to be assessed throughout the learning process. Mastery allows the instructor to assess which tasks can be performed independently (Cooper et al., 2007). Mastery is defined differently by each researcher; however, it can include completing the entire task independently with no errors once or multiple times.

Prompting

Prompting is a technique used to help an individual to complete a specific skill (Cooper et al., 2007). Prompt types are split into three main categories (least to most intrusive): verbal, modelling, and physical guidance (Cooper et al., 2007). Physical guidance includes physically completing the task with the learner using errorless learning. These prompts ensure that there is no way that the learner can make an error, however, this form of responding is very dependent on the instructor being present. Verbal prompting refers to prompts involving spoken or written (textual) words (Cooper et al., 2007). Modelling is a form of visual prompting in which an individual watches as another more experienced person completes a task. The learner is then encouraged to imitate this behaviour (Cooper et al., 2007). All these methods of prompting come in varying levels of intrusiveness and can be faded as the learner becomes more independent (Cooper et al., 2007). For example, hand over hand prompting involves the professional placing their hand on top of the learner's hand and completing the behaviour with them. This can then be faded to guiding their elbow, and finally tapping their hand to prompt them to complete the desired behaviour. Prompt fading can be used for visual, verbal, and modelling prompts (Cooper et al., 2007).

Prompting (often accompanied by other ABA techniques) has been successfully used many times to teach skills to different populations including tying shoelaces (Montalmont, 2018; Rayner, 2011), daily living tasks such as washing and cleaning (Cannella-Malone et al., 2011; Van Laarhoven et al., 2010), self-help skills such as making food (Shrestha et al., 2013), clerical skills (Bennett et al., 2013), and many more. Prompting and modelling have also proven effective for individuals learning to graph via Microsoft Excel (Tyner & Fienup, 2015), improve a golf swing (Smith, 2004), and even improve yoga poses (Downs et al., 2015).

Textual Prompting. Textual prompts are a form of verbal prompting. In ABA, verbal behaviour refers to not only spoken but also written or signed words (Cooper et al., 2007). Textual prompts help the individual to complete the desired task. Text-based prompts can be varying levels of intrusiveness, ranging from full written instructions to one-word reminders to cue the learner to complete the correct response (Cooper et al., 2007).

Textual prompting allows the learner to easily access all of the instructions for each step. This ensures that the learner can read through each step one at a time or read all of the steps before the commencement of the task. Text-based instructions do not require a monitor or mentor to teach the skills, making them a very time and cost-effective solution to teaching new skills.

Textual instructions and prompts are widely used throughout daily life, making them an effective and recognisable way to promote skill acquisition (Taylor et al., 2010).

Text-based instructions have been successfully used to teach individuals to correctly take medication (Katz et al., 2006), create graphs in Microsoft Excel (Tyner & Fienup, 2015), monitor glucose in a memory-impaired diabetic individual, (Wong et al., 2000) and learn clinical procedures (Buch et al., 2014). Although it should be noted that while text-based instructions were successful in these studies, it was found that they resulted in slower learning and less retention on follow up probes than video modelling or prompting. Text prompts are known to be effective in teaching new skills, however, they are often more effective if combined with pictorial prompts (Katz et al., 2006).

Picture Prompting. Picture prompts are a subcategory of visual prompting. Picture prompting provides a static image to be used to assist the individual complete a behaviour.

These prompts may be used in conjunction with other ABA techniques such as modelling or textual prompting. Picture prompts can help to cue the correct response in the behaviour chain (Cooper et al., 2007).

Similarly to textual prompting, pictorial prompting can be widely utilised in a range of situations. It has the benefit of being easier to create than a video model which can be time-consuming to produce. Picture prompting is a very effective strategy in aiding skill acquisition. It has been shown to be effective in teaching vocation skills in developmentally delayed individuals (Connis, 1979; Wacker & Berg, 1984; Wacker et al., 1985), food preparation skills (Lancioni et al., 1995; Robinson-Wilson, 1977), and daily living skills such as washing and cleaning (Lancioni et al., 1995; Wacker et al., 1985). Picture prompting has been shown to not only be effective in teaching new skills, but the new skills remain during maintenance follow up probes.

Modelling. Modelling involves the student watching an experienced individual performing the desired new skill (Cooper et al., 2007; Shrestha et al., 2013). This can occur live in person; however, this may not always be practical. The cost to have a one-on-one coach teaching new skills is out of reach for many. To combat this issue, video modelling is used (Charlop-Christy et al., 2000). Video modelling provides a unique solution where the learner is provided with one-on-one instructions and they are able to access this information at any time (Shrestha et al., 2013). Video modelling is becoming an increasingly popular method of instruction both within and beyond the field of ABA.

Over the shoulder point of view (POV) video modelling is a method of pre-recorded modelling in which the individual can see the task as if they are performing it (Hine & Wolery, 2006; Shrestha et al., 2013). This method of modelling can be helpful for tasks that may be more subtle and when front-facing cameras may miss important details (Hine & Wolery, 2006; Shrestha et al., 2013).

Comparison of Prompting Styles in Various Populations

Unfortunately, there is only one study found that examines the comparison of prompting techniques used to teach technology skills to an elderly population (Pachis, 2017). However, there are a handful of studies that explore the comparison of prompting styles to aid in skill acquisition.

Techniques based in ABA such as prompting have been utilised to teach medical students, though it was not specifically referenced as ABA (Buch et al., 2014). Buch et al. used video and text-based instructions to teach 60 medical students prior to an exam. Both methods of instruction were found to be effective with very little difference between the conditions. However, the video-based group performed better on a follow-up probe one month later (Buch et al., 2014).

Similarly, a study examining the success of video and text-based interventions on cessation of smoking found that the video-based intervention was the more effective prompt type. Participants within the video condition were more likely to cease smoking and stay abstinent long term compared to both the text and control conditions (Stanczyk et al., 2016).

Bennett and colleagues researched whether a voice-over narration would impact how successful a video prompting instruction would be when teaching adolescents with autism clerical skills. Utilising an adapted alternating treatments design, it was found that the differences between conditions were negligible (Bennett et al., 2013).

Different types of prompting (text prompts and video modelling) were compared to teach graphing skills in Microsoft Excel (Tyner & Fienup, 2015). These conditions were both more effective than the baseline or no instruction condition, however, it was determined that those in the video modelling group constructed graphs quicker with fewer errors than the other conditions (Tyner & Fienup, 2015).

Present Study

Gaps in the Literature

Literature examining technology and its barriers, benefits, and downfalls when used in an elderly population is numerous. However, studies which collect new data on the numbers of older adults using the internet and communication technology were difficult to find. The studies on this topic seemed to either collect data based on a much earlier census type survey or are systematic reviews of previous literature. Due to the lack of new studies, some of the statistics cited in this literature review are dated.

While the comparison of prompting, modelling, and chaining procedures has been explored previously in the literature (Bennett et al., 2013; Buch et al., 2014; Cannella-Malone et al., 2011; Hur & Osborne, 1993; Mechling et al., 2014; Moore & Quintero, 2019; Perilli et al., 2013; Smith, 1999; Stanczyk et al., 2016; Tyner & Fienup, 2015; Van Laarhoven et al., 2010), there is very little information about comparing the efficiency and effectiveness of the different procedures to teach new skills to an elderly population. Only one study has been identified, Pachis 2017, which is the research the current study aims to replicate and expand.

Modification of Pachis Study

Two main limitations were identified in the original Pachis study. These include the requirement of having two devices (one to watch the video model prompts and one to complete the tasks) and the mismatch of the tasks in terms of number of steps and difficulty. To address these limitations, several methodological changes have been implemented: a) modify the visual prompting condition so that only one device is needed, and b) choose tasks with the same number of steps and as close in difficulty as possible (as assessed by similarity of motion and amount of time to complete each task by a high-level iPad user).

Pachis employed an alternating treatments design with an initial baseline phase and follow up. However, for the present study, this will be modified to a three-phase alternating treatments design with initial baseline probes, intervention and follow up phase, and a final best-intervention phase. Changing the baseline phase to baseline probes was done to reduce the aversive nature of the prolonged no-treatment baseline phase. While it is important to gain an understanding of the baseline technological knowledge of the participants, asking them to complete a task they do not know how to complete repeatedly could be distressing. To solve this issue, baseline probes were employed, which allowed the researcher to collect data on the participant's current technological knowledge without it being too aversive. The introduction of the best-intervention only phase on the baseline probe skill will provide a further measure of experimental control (Cooper et al., 2007).

Purpose

This study aims to investigate the most efficient and effective way to teach technological skills to a New Zealand based elderly population using ABA techniques. The main research questions this study aims to answer are a) can Pachis' 2017 results be replicated in a New Zealand elderly population, b) are prompt-based interventions effective for teaching technology skills to an elderly population, and c) is one type of prompting more effective or efficient than another. It is hypothesised that video modelling with accompanying picture prompts and text prompts with accompanying picture prompts will be similarly effective in technology-based skill acquisition in a New Zealand-based elderly population. However, it is hypothesised that the skills taught via video modelling with accompanying picture prompts will be maintained to a higher level on follow up than those taught via text-based prompting with accompanying picture prompts.

Method

Ethical Approval

Ethical approval for this research was granted by The University of Waikato's Human Research Ethics Committee (HREC(Health)2021#27). Informed consent to work with residents within a retirement home was granted by the Health Liaison on behalf of the retirement home. The participant gave permission to be involved in the research.

Participants and Setting

A local retirement home was approached by the researcher to see if they expressed interest in allowing the research to be conducted with their residents. The administration staff were provided with information regarding the nature of the study via telephone and email. The researcher provided copies of the participant information sheet, institution information sheet, and a flyer they could distribute amongst their residents. Once approval was granted by management, administration staff placed the flyer in the weekly newsletter which was distributed to all residents. Any residents who expressed interest in participating in the research were asked to seek further information (participant information sheet) from administration. If they wanted to proceed, they were asked to give their details to staff who passed these details along to the researcher. Residents who expressed interest were then met face to face by the researcher who explained the research, participant information, and consent. See Appendices A, B, C and D.

Three adults over the age of 65 were recruited from their retirement home to participate in this study. However, due to the ongoing lockdowns due to the COVID-19 pandemic, only one older adult was able to complete the study. The participant lived in a private serviced home on the retirement home grounds. No known cognitive impairments were reported. The participant had limited to no experience using any type of tablet technology (e.g., iPad). In order to protect the privacy of the participant, they have been given a pseudonym.

“Wendy” was a 72-year-old woman. She primarily used her (Android) cell phone to text and phone her family. During the pandemic, Wendy used a desktop PC, with the help of her husband, to talk to family via Skype. Wendy had never used or owned an iPad prior to this study.

Prerequisite Skills

Before the commencement of the research, the participant was required to demonstrate they had the prerequisite skills needed to participate in the study. The participant was asked to first read a simple sentence in size 16 Times New Roman font on a standard A4 sheet of paper. The participant was then asked to use the provided iPad to type the famous pangram “the quick brown fox jumps over the lazy brown dog”. This sentence ensured that the participant used all 26 letters of the iPad keyboard. This demonstrates they were able to perform the necessary finger movements to use an iPad such as tapping, scrolling, and swiping, in addition to familiarising them with the iPad’s keyboard.

The participant was also asked to watch and listen to a short audio clip which asked them to draw a circle and then to draw the shape described in the video. This ensured that the participant could hear the instructions being given. This could help to mitigate the potential confounding variable of the participant performing poorly on the video modelling instructions due to hearing difficulty. External speakers were provided if necessary. The participant was asked to adjust the volume until it was played at an appropriate volume. Wendy did not require the use of the external speakers.

Independent and Dependent Variables

The independent variable for this research was the different prompt conditions used to teach the new technology skills. These prompt conditions included video modelling with accompanying picture prompts and text-based prompts with accompanying picture prompts.

Two dependent variables were recorded in this study: the number of correct independent responses and the number of sessions until mastery was achieved. In each session, the number of correct independent responses was recorded. This data was then used to create a percentage of correct responses. Correct independent responses were defined as the correct step in the behaviour chain being initiated without instruction and within 10 seconds of the previous response or initiation of the session. Mastery was defined as 100% correct independent responses across three consecutive sessions. These dependent variables were used to assess the effectiveness of each prompt condition. In addition to the two main dependent variables, the number and type of errors were collected as well as requests for help.

Materials

Prompt Materials and Task Analysis

The tasks chosen for this research were selected by consulting the original study by Pachis, conducted in 2017, and assessing which tasks had the potential to enhance social connections. Three tablet-based tasks were chosen for this research: sending an email, downloading a free application, and using FaceTime. These tasks were chosen as they all involve increasing social connections while using an iPad. All tasks were analysed via a task analysis to determine the steps needed to complete the chain of behaviour.

Sending emails is a well-known way of staying in touch with loved ones, while video calling has become very popular in recent months due to the ongoing COVID-19 pandemic and subsequent lockdowns. These tasks were retained from Pachis' study as the present researcher agreed they were crucial to iPad based social connections. In addition, the task of downloading an application from the AppStore was selected as it opens a world of possibilities for the technology user. With the acquisition of this skill, the user will be able to download anything they choose, from online games to health-based applications.

Task analyses helped to ensure that the chosen tasks were equal in the number of steps and duration taken to complete the task to avoid introducing confounding variables. These could include one task being more difficult to complete or having more steps than the remaining tasks. The researcher performed each task to determine the steps of behaviour that made up the task (step by step analysis presented in Table 1). Each task was completed three times to obtain the mean length of time taken to complete the task, the number of steps performed, and finger movements involved. Mean times for task completion were 25 seconds, 22 seconds, and 25 seconds for downloading an application, sending an email, and making a video call respectively. Each task required seven steps to complete. The nature of the finger movements required was also similar amongst the tasks, with all three utilising the "finger touch or tap". Downloading an application also required a "scrolling" or "swiping" movement.

Table 1

Task Analyses for Three iPad-Based Tasks

	Downloading an application	Sending an e-mail	Making a video call via FaceTime
1.	Tap the “AppStore” application	Tap the “Mail” application	Tap the “FaceTime” application
2.	Tap the “Search” icon at the bottom right corner of the screen	Tap the “compose mail” icon on the top right corner of the screen	Tap the “+” icon at the top right corner of the screen
3.	Tap the search bar	Locate the “To:” box and type the name of the person you want to email (Type “Rosie”)	Type the name of the person you wish to call (Type “Rosie”)
4.	Type some words that describe the type of application you wish to download e.g. “free puzzle”	Tap on the name of the person once it appears (Tap “Rosie”)	Tap on the name of the person once it appears (Tap “Rosie”)
5.	Tap the blue “search” icon on the iPad’s keyboard	Tap on the “Subject” box and enter a subject e.g., “Hello”	Tap the green button that says “Video”
6.	Tap the “GET” icon underneath the application’s title	Tap in the message box and type your message e.g., “Hi” or “test”	Wait for the researcher to answer the call. Make sure the camera is facing you
7.	When the AppStore asks permission to download the application, tap “Install”	Tap on the “Send” icon located on the top right corner of the screen	To end the call, tap anywhere on the screen and then tap the red “End” button on the bottom left corner

Text-based Prompts with Accompanying Picture Prompts. Text prompts were produced by the researcher. The text included on the prompt sheets was identical to the text in the task analyses. The text-based instructions were written in an enlarged font (size 16 Arial).

Picture prompts for each step accompanied the text-based prompts. The pictures were screenshots taken by the researcher, using the same iPad the participant used. Each picture illustrated a close up of the icon needed to complete the next step in the chain of behaviour. In some of the pictures, red lines and circles were added by the researcher to clearly show what needed to be done by the participant to complete the step. The pictures and text-based prompts were assembled onto a two-sided A4 piece of paper, with one for each task. The text and picture prompt sheets were laminated. See Appendices E, F, and G.

Video Modelling with Accompanying Picture Prompts. Video modelling of each step of the three tasks was produced and performed by the researcher. The videos were filmed in a point of view style and only included the iPad and the researcher's hands. Each step was recorded as each its own discrete video, meaning that each task contained seven videos, one for each step of the task analysis. This enabled the participant to watch each step before moving on to the next step at their own pace. A voice-over was included in each video which was identical to the written text-based instructions. The videos were then uploaded into private YouTube playlists, one for each task. This allowed the learner to play the video one step at a time.

In the study by Pachis in 2017, the researcher used two iPads – one for the participant to use and one to play the video modelled tasks. However, most elderly adults will not have access to two devices. To combat this problem, the present study used one iPad which is used to view the video models and also to complete the tasks.

As it would be difficult to switch between watching the video model and completing the task, picture prompts were also provided. For the purposes of this study, the researcher played the videos at the participant's request and also navigated between YouTube and the iPad's home page. This was because it would be unlikely that the participant would know how to use YouTube. Asking the participant to use YouTube and switch back and forward between the screens would add several additional steps for the tasks associated with video modelling. These confounding variables would likely affect the outcome of the study.

In addition to the video modelling, picture prompts were provided for the task. These pictures were identical to those which accompanied the text-based prompts. One picture was used for each step in the chain of behaviour. The picture prompts were assembled onto a two-sided piece of A4 paper. The picture-based instructions were laminated. See Appendices H, I, and J.

Technology

The experimental sessions required an iPad, a camera to film the sessions, data collection sheets, pens, speakers, and instructions for the participant to use during the experimental sessions. The iPad used in this research was an iPad Air which used 12.5.5 iOS. The touchscreen PC (personal computer) made by Apple weighed 0.46 kilograms and contained a 24.7-centimetre display. The iPad was used by the participant to complete the tasks.

Data Collection Forms

The data collection forms utilised in this study were based on those used in Pachis' 2017 study. The forms were modified to include the downloading an application task. See Appendices K, L, M, N, O, and P.

Pre- and Post-Experiment Questionnaires

The questionnaires used in this study were designed by the researcher in consultation with those used in Pachis' 2017 study. These questionnaires contained both Likert 5-point scales and multi-choice questions. The pre-questionnaire was used to assess prior technology use, confidence in technology, and preferred method of learning new skills. Post-experiment questionnaires assessed preferred prompt type, ease of use of each prompt style, and the relevance or usefulness of the tasks. See Appendices Q and R.

Experimental Design

A three-phase alternating treatments design with an initial baseline and a final best-intervention only phase was used to examine the research question. An initial baseline allowed the researcher to assess the baseline knowledge of the participant. Once the interventions were introduced, baseline probes were continued to assess for incidental learning, order effects, and experimental control. Once the intervention phase was completed, the most effective intervention was determined and then this intervention was implemented for the task assigned to the baseline probe condition. The addition of a final best-intervention phase added an additional measure of experimental control.

A three-phase alternating treatments design was chosen as it minimises sequence effects, allows the researcher to assess for stimulus generalisation, and minimises the problems caused by the irreversible nature of the responding (Cooper et al., 2007).

Procedure

Experimental visits to participants occurred approximately three times per week. Each visit included between one and six sessions. The interventions (intermittent baseline probe - no intervention, video modelling with picture prompts, and text-based with picture prompts) were quasi-randomly assigned to one of the three tasks (sending an email, video calling via Facetime, and downloading an application). See Table 2.

Prior to the experimental visits, the order of the tasks and associated interventions were randomly determined by Microsoft Excel. No more than two of the same type of condition were conducted within one experimental visit. These experimental visits were conducted until the participant achieved mastery criterion. If one prompt condition resulted in mastery being achieved first, it was then discontinued. The experiment involved three phases: baseline, intervention and follow up, and final best-intervention phase. During the final best-intervention phase, the video modelling intervention was implemented for the video calling (Facetime) task. Maintenance probes were conducted for the remaining tasks. Maintenance probes were conducted in the same manner as baseline (i.e., no interventions).

Table 2

Three iPad-based Tasks and Their Associated Conditions

	Condition
Downloading an application	Video modelling with picture prompts
Sending an email	Text-based prompts with picture prompts
Video calling via Facetime	Baseline probe condition

Errors and Requests for Assistance

Requests for assistance and errors were also documented during the experiment. Requests for assistance were defined as the participant asking for help at any step of the task (i.e., “I’m not sure with this one, can you help me?”). Two types of errors were recorded during the experiment: latency and topography.

To complete the steps of the task independently and correctly, the participant had to perform the step within 10 seconds of the initiation of the task or the commencement of the step prior. Any step of the task that was initiated outside this timeframe was counted as a latency error.

Topographical errors occurred when the participant performed an incorrect step or a step out of order. To complete the task steps correctly, the steps needed to be completed in the correct order.

Experimental Sessions

Baseline. The baseline phase was first conducted to measure the participant's knowledge and technology skills. This phase involved asking the participant to complete the tasks (one in each session) without any instructions. Two baseline sessions were conducted for each task. This allowed the researcher to assess their baseline iPad skills without causing the participant unnecessary stress.

The number of correct independent responses were collected for the baseline phase. If the participant could not perform the step independently, the researcher would remove the iPad from their line of sight, saying "I'll help you with that one" and completing the step before returning the iPad to the participant. If three incorrect responses were recorded in a row, the session was terminated. Incorrect responses were defined as no response within 10 seconds of the completion of the previous step or the initiation of the session, the correct step but in the wrong order, or the participant informing the researcher that they did not know the step. Correct responses were responded to with confirmation of accuracy.

Pre-intervention Probes. At the beginning of each session, a pre-intervention probe was conducted. Pre-intervention probes were conducted identically to baseline and allowed the researcher to gauge skill acquisition due to exposure to the prompt conditions. Pre-intervention probes were not conducted with the task assigned to the intermittent baseline probe condition. If the participant scored 100% correct independent responses on their pre-intervention probe, then they skipped the teaching session and moved straight to the assessment session. If they scored less than 100% correct independent responses, then they would then complete the teaching session.

Teaching Sessions. The teaching sessions were conducted similarly to the baseline probes, except that the participant was given prompts for the associated task. The participant was firstly presented with either the written text-based with accompanying picture prompts or the video modelling with picture prompts and then asked to watch or read all of the steps in the task before attempting to complete any of the steps. The participant was then asked to read or watch one step of the task at a time before attempting to complete it. The participant was then asked to continue to the next step until the task was completed. The potential for latency errors was also removed, meaning that the participant was able to read or watch the prompt for as long as they liked and as many times as they liked before attempting to complete it. Teaching sessions were not performed on task associated with the intermittent baseline probe condition. Data was collected for the duration and number of teaching sessions conducted for each associated task.

Assessment Sessions. Assessment sessions were conducted identically to baseline sessions. Participants were asked to complete a task, signalled by the researcher saying, “Could you please send an email/video call me/download an application?”. The participant then had 10 seconds to complete the first step of the task. The number of correct independent responses were recorded for the assessment sessions as well as errors and requests for help. If the participant could not perform the step independently, the researcher would remove the iPad from their line of sight, saying “I’ll help you with that one” and completing the step before returning the iPad to the participant. If three incorrect responses were recorded in a row, the session was terminated. Incorrect responses were defined as no response within 10 seconds of the completion of the previous step or the initiation of the session, the correct step but in the wrong order, an incorrect step, or the participant informing the researcher that they did not know the step.

Follow Up

A follow-up session was conducted for each task approximately one week after mastery was achieved. These sessions were conducted like the baseline phase to assess for retention of the new skill.

Best Intervention Phase

Approximately three weeks after the completion of the follow-up sessions, a best intervention phase was conducted with the Facetime video calling task that was previously used for baseline probes throughout the intervention phase. This task was assigned to the most effective intervention as determined by visual analysis of the intervention phase. Video modelling with accompanying picture prompts were determined to be the more effective intervention. The video modelling intervention was then implemented for the Facetime task, following the same method as the intervention sessions. Additional follow up sessions were conducted for the remaining tasks which were identical to baseline conditions.

A post-experiment questionnaire was also administered to the participant. This was similar to the pre-experiment questionnaire but also contained questions pertaining to their experience during the experiment and which method of instruction they preferred. See Appendix E.

Measures of Reliability and Validity

Inter-observer Agreement (IOA)

A second observer was recruited to view the recorded experimental sessions. This observer was a post-graduate psychology student who was briefed on the research, dependent and independent variables, and data collection. Inter-observer agreement was calculated to assess the accuracy and reliability of the collected data. The second observer viewed 19.44% of the sessions, including both teaching and assessment sessions and at least one session in each phase. During these observations, the second observer collected data which was then compared to the data collected by the primary observer. The IOA was calculated by dividing the number of agreements by the total number of agreements and disagreements, and then multiplying by 100. The mean IOA for all viewed sessions was 91.05% (range 77.78 to 100%). An IOA score of 80 to 100% is deemed adequate for reliability and accuracy by Cooper et al., (2007). A score of over 90% indicates that the researcher can be confident that the data changes are accurately reflected in the participant's behaviour (Cooper et al., 2007).

Social Validity

Social validity questionnaires were administered pre- and post-experiment. These questionnaires aimed to gather further information about the participant and attitudes towards technology and the research. The level of confidence with technology was assessed both pre- and post-experiment on a five-point Likert scale. The pre-experiment questionnaire also assessed the preferred method of learning new skills and preferred method of consuming information (i.e., visual – television, text – newspaper, or aural – radio). The post-experiment questionnaire was administered to gather information on preferred prompting instruction type, ease of use of each prompt type, and the relevance/usefulness of each task. These metrics were also scored on five-point Likert scales.

Data Collection and Analysis

Data was collected over a period of six weeks, with a total of 36 sessions of data collected. The sessions were broken down into six sessions of baseline probes, 19 sessions of intervention, three follow up sessions, and eight best-intervention and final follow up sessions. Experimental visits were arranged by the participant and researcher. One to three visits were conducted per week. Data was collected for both prompted and independent responses. Data was also collected on the number of teaching sessions, and duration of the sessions.

The primary dependent variable measured was the number of correct independent responses. The number of correct independent responses were then converted to percentages by dividing the number of correct independent responses by the sum of the total number of correct independent and incorrect responses. This number was then multiplied by 100 to give a percentage. The number of sessions conducted per task was also tallied. The sessions continued until mastery had been achieved – 100% correct independent responses for three consecutive sessions. Duration and number of teaching sessions were collected. The duration of the teaching sessions was recorded in minutes and seconds, and later converted to seconds.

Data was recorded on paper and then transferred to Microsoft Excel. Figures were created for correct independent responding and the number of sessions until mastery, which were then visually analysed. Tables were created to show the details of teaching sessions. Visual analysis allowed the researcher to view the data trends after each visit to the participant, and to determine whether the interventions were successful (Alresheed et al., 2013). In addition to visual analysis, the effect size was calculated to assess whether the interventions had a functional effect on the percentage of correct independent responses (dependent variable). The percentage of nonoverlapping data (PND) was calculated for each intervention. The PND refers to the percentage of intervention data that exceeded the greatest baseline data point. PND scores below 50% signify an ineffective or unreliable intervention, a score between 50 and 70% indicates a questionably effective intervention, scores between 70 and 90% indicate a fairly or moderately effective intervention, and a score above 90% indicates a highly or very effective intervention (Alresheed et al., 2013; Lenz, 2013).

Results

Data for Wendy is shown below in Figure 1. Responding during baseline varied by task. While downloading an application resulted in zero correct independent responses, low to moderate levels of independent responses were observed for both sending an email (M= 42.86%, range 28.57% to 57.14%) and video calling (M=35.71%, range 28.57% to 42.86%). During the prompt intervention phase, downloading an application was assigned to the video modelling with accompanying pictures condition, sending an email was assigned to the text with accompanying pictures condition, and video calling was assigned to the intermittently probed baseline condition (no intervention).

Once the intervention was introduced, the downloading an application task immediately showed a much higher level of responding, with zero responding during baseline to nearly 100% correct independent responses (M = 97.14%, range 85.71% to 100%). When considering the high level of correct responses and the latency of these responses after the introduction of the prompts, the data suggests that video modelling and accompanying picture prompts were very effective for skill acquisition. Mastery was achieved in five sessions and responding remained high (100%) on follow up approximately a week later.

Correct independent responding increased more slowly for the sending an email task. While the correct responses trended upwards after the introduction of text prompts with accompanying pictures, responding remained at a low to moderate level, similar to baseline, for a further two sessions after the intervention was introduced (M= 83.93%, range 42.86% to 100%). Mastery was achieved in eight sessions and responding also remained high (100%) on follow up. Visual analysis of the sending email task suggests that text prompting was also effective for skill acquisition; however, the level of responding and latency from intervention introduction suggests that it was not as efficient as video modelling for Wendy.

Correct independent responding for the video calling task remained relatively stable. After the introduction of the prompts for the other tasks, there was a slight increase in correct independent responding for the baseline probe condition (M= 42.86%, range 14.29% to 57.14%) which may be due to learning effects or stimulus generalisation. Despite this, there is a discernible difference in the level of correct independent responses between baseline probe (no intervention) and prompting conditions. This suggests that the increase in responding for the prompt conditions was due to the intervention and that the baseline probe condition was not influenced by carryover effects. Mastery was not achieved in the baseline probe condition and responding remained moderate on follow up (42.86%).

The Percentage of Non-overlapping Data (PND) was calculated for each task to assess the effectiveness of each prompt intervention. The video modelling prompt intervention yielded a PND of 1 or 100%. This indicates that none of the data collected during baseline overlapped with the data collected during intervention and follow up. A PND of 100% indicates a highly (Alresheed et al., 2013) or very effective (Lenz, 2013) intervention. The PND for text-based prompting with accompanying pictures was calculated at 0.78 or 78% which indicates that the intervention was fairly (Alresheed et al., 2013) or moderately effective (Lenz, 2013). A PND of 0.29 or 29% was calculated for the intermittently probed baseline condition.

The effectiveness of the interventions determined by visual analysis is strengthened by the PND which also confirms that both prompt types were effective interventions; however, the video modelling intervention was more effective than the text-based intervention. In both the visual analysis and PND calculations it was established that the intermittently probed baseline condition yielded no significant improvement in percentage of correct independent responses.

Final Best-Intervention Phase

After the completion of the follow-up phase, the collected data was analysed via visual analysis and the calculation of the PND to determine which intervention was more effective. It was determined that video modelling with accompanying picture prompts was more effective than text-based prompts with accompanying picture prompts. Video modelling with accompanying picture prompts was then implemented for the video calling (Facetime) task. Maintenance probes were conducted for the sending an email and downloading an application tasks.

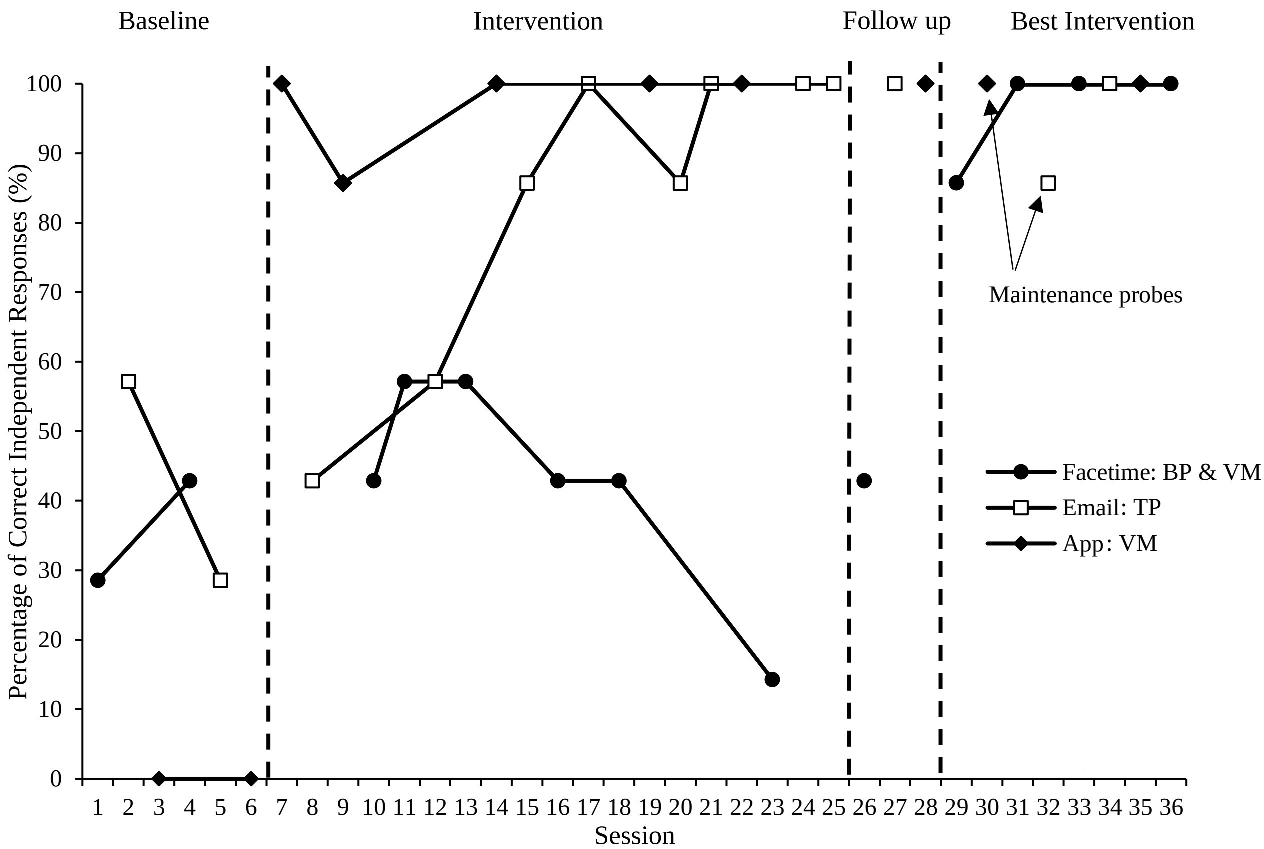
Upon the implementation of the intervention, responding for the video calling task immediately increased (M=96.43%, range 85.71% to 100%). Responding remained high and mastery was achieved in four sessions. The latency from the introduction of the intervention and increase in responding suggests that video modelling with accompanying picture prompting was very effective when teaching the video calling task.

Maintenance probes for the original video modelling intervention task (downloading an application) remained high (M=100%). Maintenance probes for the text-based prompts with accompanying picture prompts remained high and increased to 100% after one session (M=92.86%, range 85.71% to 100%).

The PND for the best-intervention phase video calling task was calculated to assess the functional relationship between the intervention and resulting responding. The PND for the video modelling with picture prompt condition was 1 or 100%. As described by Alresheed and colleagues in 2013, this indicates that video modelling with picture prompts is a very or highly effective intervention. Visual analysis of this phase confirms the results of the PND. The introduction of the intervention is associated with a positive increasing trend of responding and a short latency between intervention and increase in responding.

Figure 1

Percentage of correct independent responses for three iPad-based tasks during baseline, intervention, follow up, and best-intervention phases.



Note. Abbreviations: Baseline Probes (BP), Text-based Prompts (TP), and Video Modelling (VM). Video calling (Facetime) task was initially assigned to BP condition and then VM for the Best-Intervention phase.

Teaching Sessions

While not a primary dependent variable, data on the number and duration of teaching sessions was also collected. This data helped determine the effectiveness of the prompt interventions. This data is summarised in Table 3. Sending an email (text prompts with accompanying picture prompts) required twice the amount of teaching sessions than downloading an application (video modelling with accompanying picture prompts). The total duration spent on ‘sending an email’ teaching sessions was more than twice as long spent on the ‘downloading an application’ teaching sessions. This data supports the idea that video modelling with accompanying picture prompts was more efficient in technology skill acquisition with fewer teaching sessions and faster achievement of mastery when compared to text prompts with accompanying picture prompts.

Table 3

Summary of Duration and Quantity of Teaching Sessions for Technology Skill Acquisition

	Video modelling with accompanying picture prompts	Text prompting with accompanying picture prompts
Number of teaching sessions to achieve mastery	3	6
Average duration of teaching session (seconds)	243	282
Total duration of teaching sessions (seconds)	729	1692

Teaching Sessions for Best-Intervention Phase

During the best-intervention phase, video modelling with picture prompts was introduced for the video calling task. Two teaching sessions were conducted during this phase. The average duration of the teaching session for this phase was 250 seconds (range 230 to 270 seconds). No teaching sessions were conducted during the maintenance probes during the best-intervention phase.

Social Validity

Pre- and post-experimental questionnaires were administered to assess confidence in technology, the preferred method of prompting, and the usefulness/relevance of the tasks. Confidence in technology and the usefulness/relevance of the tasks was measured on a Likert scale from 1 to 5. Prior to the commencement of the study, Wendy rated her confidence with technology at between 2 and 3, with 1 being not confident and 5 being very confident. After the study had concluded, this had increased to very confident. In the pre-experimental questionnaire, Wendy indicated that she preferred to be taught novel skills by another person or via watching a video model. After the study had concluded, Wendy indicated that she preferred the video modelling prompt type and that she would use this method again to learn new skills. The ease of use for each prompt type was also measured on a Likert scale from 1 to 5, with 1 being not very easy to use and 5 being very easy to use. Wendy scored the video modelling prompt as very easy (5) and the text prompts as easy (4). When assessing the helpfulness of the prompt type, video model prompting was scored as very helpful (5), and text prompting was scored as neutrally helpful (3). On the usefulness/relevance of tasks, all tasks were scored as very relevant/useful (5).

Discussion

The purpose of this study was to conduct a systematic replication of a 2017 study by Pachis, and to provide external validity to their research. The original study was extended and modified to see if the results would generalise to a New Zealand-based elderly population. The present study aimed to examine if prompting techniques could be used to aid in technology-based skill acquisition in an elderly population, and if so, which method of prompting was more effective. The prompting styles used in this research were text-based prompting and video modelling, both with accompanying picture prompts.

It was hypothesised that both text-based prompting and video modelling would be similarly effective for skill acquisition in older adults, though it was thought that results for video modelling would be maintained on follow up and maintenance probes. Text-based prompting and video modelling both proved to be effective at teaching technology skills to an elderly New Zealander. On analysis of the collected data, video modelling was a more effective and efficient way to teach technology skills than text-based prompts, with less time spent in teaching sessions and fewer intervention sessions required to reach mastery. This effect was replicated when the best-intervention was imposed upon the baseline probe skill. Video modelling also produced a higher level of responding during maintenance.

These results contrast with Pachis' 2017 study where prompting styles were equally effective in two out of the three participants. In the present study, video modelling provided a more effective method of aiding in skill acquisition than text-based prompting. The current study also saw a much more consistent level of responding after implementation of the interventions. Pachis' study saw more variable results which took longer to stabilise.

The main result of this study is that video modelling proved to be a more efficient and effective way to teach iPad skills to an older New Zealander. While both interventions proved to be effective, video modelling required less teaching and assessment sessions to achieve mastery than text prompting. Text-based prompting was associated with more errors and teaching sessions required to achieve mastery. Prior to the introduction of the intervention, there were no correct independent responses for the 'downloading an application' task (assigned to video modelling intervention). However, after the implementation of the intervention, responding was high and remained relatively stable throughout the rest of the research.

This pattern was not seen in the 'sending an email' task (assigned to the text prompts). In this task, responding during baseline was moderate. Once the prompts were introduced, the level of correct independent responses increased slowly over three sessions. This supports the research conducted in 2006 by Katz et al., who highlighted that tasks taught via text-based prompting are slower to learn and may be less maintained on follow up.

During baseline, responding for the 'sending an email' and 'video calling' tasks were low to moderate. This could be due to the participant having previous experience with both tasks, albeit while using an Android device. While using an iPad and Android is very different, steps of these tasks could be similar enough to evoke stimulus generalisation between the different types of technology.

There was an initial increase in responding in the baseline probe condition (video calling task) after the introduction of the text-based instructions. This could be due to stimulus generalisation between the steps in the video calling and email tasks (Cooper et al., 2007). In both tasks the participant was required to tap in a search bar, type the researcher's name, and then select the name from the list which appears once you begin typing. Once these steps were taught with the 'sending an email' task, they could be generalised to the 'video calling' task.

Prior experience with technology is correlated with better outcomes when learning technology skills (Warren-Peace et al., 2008). The participant regularly uses Skype on her desktop computer. While this is a different procedure to using Facetime on an iPad, it does have a few similar steps: clicking/tapping on the video call icon to begin the call and clicking/tapping the red end call icon to end the call. This prior experience may have resulted in these steps being performed correctly throughout the baseline phase and baseline probe condition when completing the 'video calling' task. This higher-than-expected level of responding during baseline correlates with some of the current literature regarding prior experience and the success of the learner. It was discussed that when teaching technology skills in older adults, prior experience is one of the most important factors in predicting success in learning outcomes in older adults (Warren-Peace et al., 2008).

However, during the intervention phase of the present study, a novel task taught via video modelling (downloading an application) was learnt much faster than a semi-familiar task taught via text-based prompting (sending an email). It was stated in Warren-Peace et al., that previous experience resulted in the skills being learnt faster than if they were completely novel to the learner. The present results do not support this finding. However, during the final best-intervention phase, a semi-familiar task was taught rapidly via video modelling (video calling via Facetime). Mastery was achieved for this semi-familiar task in four sessions. This may suggest that the success of a task is not due to the level of familiarity or experience, but rather the method of teaching said task.

While the success of the video model was not unexpected, it was thought that the text-based prompting would yield very similar results (Buch et al., 2014; Pachis, 2017). The success of the video modelling could be due to multiple factors. Video modelling is helpful in that the learner is able to see exactly what needs to happen to complete the next step, while text-based prompts can be more difficult with the potential for ambiguous text instructions. While the researcher took care to avoid this by ensuring the voice over instructions for the video modelling and the text instructions were identical, it could be that the participant disregarded the voice over and simply watched the video. It would be interesting to assess whether the addition or removal of a voice over in the video modelling condition would make a difference in the success of the intervention for older participants.

Another factor which may have contributed to the success of the video modelling condition, is the possibility of reduced overselectivity (Charlop-Christy et al., 2000). Overselectivity refers to responding due to stimuli or cues that are not relevant. This is commonly seen in individuals with autism, but also in neurotypical elderly adults (McHugh & Reed, 2007). The use of a video model allows the participant to see exactly what they need to do to complete the required step by removing the irrelevant stimuli (Charlop-Christy et al., 2000). In addition to removing the irrelevant stimuli, the relevant stimuli and cues are made salient which allows for an improved learning experience (Buch et al., 2014; Tiong et al., 1992).

Finally, a video model provides a method of learning that is more similar to a real-life scenario of one-on-one teaching (Mechling & Gustafson, 2009). One-on-one teaching is still the preferred method of teaching older adults (John, 1981; Lee, 2015). However, this method of teaching is likely to be costly and unobtainable for many older adults. Video modelling is an ideal solution in that it provides the learner with a one-on-one like experience, but it is not as costly as in person teaching (Charlop-Christy et al., 2000).

Previous research demonstrates that responding due to video modelling is likely to be more maintained on follow up than responding due to text-based prompting (Buch et al., 2014; Katz et al., 2006). The present study confirms these results. While responding for both sending an email and downloading an application remained high during follow up approximately a week later, this was not the case during maintenance. Maintenance probes were conducted simultaneously during the best-intervention phase. This occurred approximately three weeks after the conclusion of the follow up phase, and approximately four weeks after the conclusion of the intervention phase. Responding during maintenance for the original video modelling task (downloading an application) remained at 100% correct responses. However, responding for the text-based prompt task (sending an email) was lower at 85.71%, and increasing to 100% in the second maintenance probe session.

It was noted that during the sending an email intervention phase, Wendy was noted to make similar mistakes during each session. These mistakes usually were related to sending the email before entering anything in the message box and also not adding the correct contact into the appropriate field. Warren-Peace et al. (2008) noted that this is a common trend among older learners. However, this same trend was not noted in the tasks associated with the video modelling tasks.

The high efficacy of the video modelling prompting is in line with previous research which demonstrates it to be an effective way to teach a variety of skills from making breakfast to using Microsoft Excel (Buch et al., 2014; Shrestha et al., 2013; Stanczyk et al., 2016; Tyner & Fienup, 2015). Video modelling has proven to be very effective for both neurotypical and neurodiverse populations. However, it is not commonly researched among elderly populations (Pachis, 2017). This research demonstrates that it is an effective teaching tool.

Social Validity

Prior to the commencement of the research, the participant was asked to complete a social validity questionnaire. This was repeated after the completion of the research. In line with Pachis' research, the level of confidence in the participant's technology skills increased after the completion of the study. In addition to strengthening the research completed by Pachis, this confirms that interventions based in ABA such as prompting, and video modelling can be used to aid in skill acquisition and increase feelings of confidence in technology. This idea is also supported by previous literature (Carpenter & Buday, 2007; Chopik, 2016; Gatto & Tak, 2008; Heo et al., 2015; Khosravi et al., 2016; Van De Watering, 2005).

The social validity questionnaire also aimed to assess the preferred way the participant consumed information and their preferred method of being taught new skills. Wendy preferred to consume information from a radio and preferred to be taught new skills via an instructional video or someone helping her one-on-one. This prompt preference aligned with the results of this study, where video modelling resulted in fewer teaching sessions and less sessions until mastery when compared with text-based prompting. The idea of prompt preference and how it correlates to prompt efficiency would be an interesting area for future research.

Theoretical and Practical Importance

This research adds to the existing knowledge on the use of prompting and modelling to aid in skill acquisition. The results from this study show that both video modelling and text-based prompting were effective ways to teach technology skills in an older population. It was found that video modelling especially, produced a highly accurate performance immediately after introduction of the intervention. This responding remained high on follow up and maintenance which suggests the results were stable.

The use of technology to teach technology skills is a relatively understudied area of research (Pachis, 2017). However, it is very useful in that a premade video or text-based instruction sheet can be used successfully to teach these skills in a short period of time. This provides an easy and time-efficient way for individuals to teach their elderly peers new skills. Additional research is needed in this area, but the results of this study are promising for the area of education in older adults. Past research highlighted that a 'traditional' study environment of a teacher lecturing a group of students is not very effective in older learners (Boulton-Lewis, 2010; Lee, 2015; Morris & Ballard, 2003). However, the most effective way to teach these populations is still debated, with one-on-one teaching being the preferred method (John, 1981; Lee, 2015). ABA prompting techniques are beneficial in that they provide a feeling of one-on-one teaching, without the cost of such lessons (Charlop-Christy et al., 2000). Video modelling and text-based instructions provide older adults the tools to learn the desired skills at their own pace.

This study also extends the research conducted in the field of ABA, which concerns the use of prompting techniques on a neurotypical population. Past studies have included techniques rooted in ABA to help individuals to learn a variety of new skills, however, there appears to be a lack of these types of studies being conducted in elderly populations (barring the Pachis study of 2017). The present research illustrates that these techniques are very successful in aiding technological skill acquisition in an elderly population.

Limitations and Future Research

There are three major limitations that could be addressed in future research. The first limitation concerns the use of a single participant. While single subject case designs are valid and experimentally sound, it would have been preferable to have three to four participants. Recruiting additional participants would allow the researcher to examine effect sizes for more data samples. While the present results demonstrate good experimental control, there is always a small chance that they were due to confounding variables rather than the implemented intervention (Cooper et al., 2007). Further participants would also benefit the research in that each task could be quasi-randomly assigned to each participant, so each task was conducted in each condition. This would further benefit the research to ensure that one of the tasks was no more difficult or time consuming than the others. In future it would be preferable to recruit additional participants so if some need to withdraw from the study, there would still be adequate numbers of participants. Additional participants would also help to assess whether prompt preference has any relationship with the most effective prompt type.

The second limitation was the time constraints due to the ongoing COVID-19 pandemic. As the participant resided in a retirement home, when COVID-19 began to increase in the community, the retirement home made the decision to close their premises to visitors unless they were family. Due to this, the final best-intervention phase had to be conducted approximately three weeks after the completion of the follow up. If these constraints did not exist, it would have been preferable to conduct the best-intervention phase directly after the follow up, and then assess for maintenance for all three tasks at a later date. Due to the constraints, maintenance for two of the tasks and the best-intervention phase had to be conducted simultaneously. It would be interesting to see if the video calling task (best-intervention video modelling phase) would yield the same high level of responding during maintenance as the original video modelling task.

The final limitation regarded the methodology of the study. Due to the limit on the number of visitors at the retirement home, it was not possible to recruit a second observer or assistant to help in person. It was difficult to conduct the research, collect data, and video record the sessions while attempting to maintain experimental integrity. In future, it would be beneficial to gain access to an assistant who could help with video recording.

Two prompting procedures were very successful in technology skill acquisition in an elderly participant. However, it is unclear whether this success would be generalised to more difficult technology-based tasks or even to non-technology-based tasks. This study focused on iPad-based tasks which promoted social connections; however, future research could focus on technology tasks focused on health and health management. Prior literature demonstrated the benefit of older populations using technology to access appropriate health related information (Gell et al., 2015). Though it would be important to incorporate information about data security and false information.

In the ‘download an application’ task, it was noted that Wendy quite often chose to download the first application shown on the screen which was quite often a paid promotion that had little relevance to her search terms. In the future, it may be worthwhile to include a discrimination task. This will help the participant to make an appropriate choice on which application to download.

Conclusion

Technology is rapidly advancing, and elderly populations are often left behind. In addition to keeping up with technology, it is important for an elderly population to be familiar with technology as it is well documented to aid in reducing social isolation and loneliness. Higher technology use is correlated with higher satisfaction, a reduction in feelings of depression and loneliness, and an overall increase in quality of life. Despite this, the level of older adults using technology is significantly lower than their younger peers.

This study utilised a single subject three phase alternating treatment design with multiple baseline probes. The aim of the study was to assess the effectiveness and efficiency of two prompting procedures to aid skill acquisition of technology skills. Video modelling and text-based prompting, both with accompanying picture prompts, were compared to assess their efficacy in a New Zealand-based elderly population and to determine which method was more effective and efficient in aiding skill acquisition. A final best-intervention phase was conducted to provide an added measure of experimental control.

The results of this study demonstrate that both video modelling and text-based prompting are effective in aiding skill acquisition in older populations. However, video modelling was shown to be more effective due to the fewer errors, reduced number of sessions until mastery, less time spent on teaching sessions, and increased effect size (PND). Responses on tasks associated with video modelling provided higher, more reliable results on follow up and maintenance probes. These interventions were associated with an increase in confidence in technology. Overall, the results of this study illustrate that techniques based in ABA such as task chain analyses, chaining, text-based prompting, and modelling are very effective in aiding in technological skill acquisition in a New Zealand-based elderly population.

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Appendices

Appendix A: Participants Wanted Poster

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Research Participants Wanted

Researcher: Rosie Stenersen-Kain Master's thesis supervised by Associate Professor Angelika Anderson

Teaching New Technological Skills via Applied Behaviour Analysis Principles

What is it about?

This experiment is designed to help us understand how to teach novel technology skills to a New Zealand based elderly population. If you wish to participate, we will ask you to complete three tasks: a pre-experimental questionnaire, the main body of the experiment where you will learn the new skills, and a post-experimental questionnaire.

We will be using Applied Behaviour Analysis (ABA) techniques to teach you these skills. ABA is a field in psychology which is focused on learning and behaviour changes.

How much time will participation involve?

The pre- and post-experimental questionnaires will take roughly ten minutes each to complete.

The main portion of the experiment will take several sessions (visits to you) over two to three weeks. Each session is expected to last roughly an hour including frequent breaks.

Who can take part?

Participants must meet the following criteria:

- Aged 75 years or older
- Living in a retirement home
- Have not engaged in technological skills classes (currently or previously)
- Able to read size 16 Times New Roman font on an A4 sheet of paper
- Able to hear a video played on an iPad (can increase or decrease sound as required)
- Able to manipulate fingers and hands to perform necessary movements on the iPad – scrolling, tapping, typing, and manipulating the physical buttons

If you are interested, please contact the main office for more information.

This research project has been approved by the Human Research Ethics Committee (Health) of the University of Waikato. Any questions about the ethical conduct of this research may be sent to the chair of the committee (humanethics@waikato.ac.nz).

Appendix B: Institution Information Sheet

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Associate Professor Angelika Anderson
Faculty of Social Science
Waikato University
Phone: 07 838 4466 ext 9209
Email: angelika.anderson@waikato.ac.nz

Rosie Stenersen-Kain

Email: ors2@students.waikato.ac.nz

Institution information sheet

To whom it may concern,

My name is Rosie Stenersen-Kain, and I am currently enrolled at the University of Waikato completing my Master of Applied Psychology in Behaviour Analysis with Associate Professor Angelika Anderson from the School of Psychology. I hope to conduct my study teaching an elderly population, who reside in retirement homes or aged care facilities and who are interested in learning some basic internet skills, technology skills. I am seeking your permission to recruit participants for this research at your institution and also to conduct this project there. If you are happy for us to conduct this study at your institution, we require written permission in the form of an email or letter. If you would like further information about the project, please contact myself or Associate Professor Anderson via the contact details above.

The topic of the research

This research is to investigate the most effective way to teach new technology skills to an elderly population. We aim to teach three to four of your residents (our participants) how to complete three tasks on an iPad using modelling and prompting. The tasks were chosen to help reduce the social isolation of elderly people. The modelling and prompting types will be an instructional video and text-based instructions. We want to find out which method of teaching works best and whether learning new skills on the iPad increases confidence with technology. For each session, I will provide an iPad for the participant to use, but unfortunately, we are unable to provide iPads for your residents to keep.

What's involved

1. **Recruitment**

We would like to place an advert in your weekly newsletter asking for participants (see attached poster). Potential participants can then make contact with the me via phone. We are seeking approximately 3-4 participants. Potential participants will be given a participant information sheet and consent form and the opportunity to read through these documents and sharing with family/friends/whanau as they wish. I will follow up by phone or in person, to answer any questions they may have. Participation in this study is entirely voluntary and the participants may withdraw at any point with no penalty. If the participant wishes to withdraw, they can let me know at any time. Choosing not to take part in the research should not impact their care or relationship with the rest home in any way

2. **Project**

There are three tasks' parts to this project:

1. The participants will be asked to fill in a pre-experiment questionnaire and a post-experiment questionnaire. Both the pre- and post-experiment questionnaires will only take 10 minutes to complete. After completing the pre-experiment questionnaire, we will organise a time with the participant to start the teaching part of the research.
2. First, we will just watch the participant to find out what they already know about using an iPad. We will ask them to complete a task without any instructions.
3. Then we will teach the participant how to complete two iPad-based tasks. This will take several sessions (visits to the participant) over the course of a couple of weeks. Each session will last roughly one hour. However, there will be many breaks and the opportunity to stop and reschedule if required. In these sessions we will give the participant either a video to watch or written instructions (with pictures) to read. The researcher will also give/show them the steps one at a time, and they will be allowed to practice each step. After each step is completed, the researcher will ask them to complete the given task. If they are able to complete the task, we will move on to the next stage. If they are not able to complete the task, we will repeat the instructions.

These sessions will be conducted one on one with consenting participants and video recorded. These videos will only be accessed by the researchers and will be securely stored at the University of Waikato. We will work with you and the participants to identify the most suitable times for these sessions such as to not disrupt your routines any more than is absolutely necessary.

Results

It is expected that, as a result of the intervention, the participant will be able to use an iPad to download a free application from the AppStore, write and send e-mails, and make a video call. Results will be presented within my master's thesis. It is also possible that results will be published in a journal article and/or presented at a conference. A summary of the results can be forwarded to the participants on request, as can a copy of any published journal articles.

What will happen to the information collected?

The information collected will be used by the researcher to write a research report for the credit of a specific paper. Only the researcher and supervisor will have access to the original notes, documents, and recordings. No participants, nor the name of your institution will be named in any report or publications.

Confidentiality

Participation in this project will remain confidential and no identifying information will be disclosed to anyone outside of the study. Codes and pseudonyms will be assigned to participants. No participants will be identifiable in the presentation of any results.

Storage of data

On completion of my thesis all data will be given to my supervisor, Associate Professor Angelika Anderson, to be stored on a password-protected university drive for five years. Only Associate Professor Anderson and I will have access to the data at any time. After five years the data will be destroyed by deleting the electronic files.

Right to withdraw

Participation in this project is voluntary and your residents are under no obligation to give consent to participate. All participants have the right to withdraw from the project at any time, for any reason, and with no consequence.

Who is responsible?

If you have any questions or concerns about the project, either now or in the future, please feel free to contact either

Rosie Stenersen-Kain: ors2@students.waikato.ac.nz , or
Associate Professor Angelika Anderson Phone: 07 838 4466 ext 9209

Yours Sincerely,

Rosie Stenersen-Kain and Angelika Anderson

This research project has been approved by the Human Research Ethics Committee (Health) of the University of Waikato. Any questions about the ethical conduct of this research may be sent to the chair of the committee (humanethics@waikato.ac.nz).

Appendix C: Participant Information Sheet

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Associate Professor Angelika Anderson
Faculty of Social Science
Waikato University
Phone: 07 838 4466 ext 9209
Email: angelika.anderson@waikato.ac.nz

Rosie Stenersen-Kain
Phone: 0278709567
Email: ors2@students.waikato.ac.nz

Participant Information Sheet

To whom it may concern,

You are invited to participate in a research project conducted by myself, Rosie Stenersen-Kain, under the supervision of Associate Professor Angelika Anderson from the Faculty of Social Science at the University of Waikato. This project is part of the requirement for the completion of my Master of Applied Psychology in Behaviour Analysis at the University of Waikato. Please read this information sheet in full before deciding if you will participate. If you would like further information about the project, please contact myself or Associate Professor Anderson via the contact details above.

The topic of the research

This research is to investigate the most effective way to teach new technology skills to an elderly population. We aim to teach you how to complete three tasks on an iPad using modelling and prompting. The modelling and prompting types will be an instructional video and text-based instructions.
We want to find out which method of teaching works best and whether learning new skills on the iPad increases your confidence with technology.

What's involved

There are three tasks that we will ask you to complete:

1. we will ask you to fill in a pre-experiment questionnaire and a post-experiment questionnaire. Both the pre- and post-experiment questionnaires will only take 10 minutes to complete. After completing the pre-experiment questionnaire, we will organise a time with you to start the teaching part of the research.
2. First, we will just watch you to find out what you already know about using an iPad. We will ask you to complete a task without any instructions. This allows us to collect baseline data to compare later.
3. Then we will teach you how to complete two iPad-based tasks. This will take a little more time. We will conduct several sessions (visits to you) over the course of a couple of weeks. Each session will last roughly one hour. However, there will be

many breaks and the opportunity to stop and reschedule if required. In these sessions we will give you either a video to watch or written instructions (with pictures) to read. You will be instructed to read or watch the instructions in their entirety before attempting to complete any of the steps. The researcher will then give/show you the steps one at a time and you will be allowed to practice each step. After each step is completed, the researcher will ask you to complete the given task. If you are able to complete the task, you will move on to the next stage. If you are not able to complete the task, we will repeat the instructions.

These sessions be video recorded. These videos will only be accessed by the researchers and will be securely stored at the University of Waikato.

Results

It is expected that, as a result of the intervention, you will be able to use an iPad to download a free application from the AppStore, write and send e-mails, and make a video call. Results will be presented within my master's thesis. It is also possible that results will be published in a journal article and/or presented at a conference. A summary of the results can be forwarded to you on request, as can a copy of any published journal articles. Please contact the researchers if you would like to see a copy of the results.

What will happen to the information collected?

The information collected will be used by the researcher to write a research report for the credit of a specific paper. Only the researcher and supervisor will have access to the original notes, documents, and recordings. No participants will be named in the publications and every effort will be made to disguise their identity.

Confidentiality

Participation in this project will remain confidential and no identifying information will be disclosed to anyone outside of the study. Codes and pseudonyms will be assigned to participants. No participants will be identifiable in the presentation of any results.

Storage of data

On completion of my thesis all data will be given to my supervisor, Associate Professor Angelika Anderson, to be stored on a password-protected university drive for five years. Only Associate Professor Anderson and I will have access to the data at any time. After five years the data will be destroyed by deleting the electronic files.

Right to withdraw

Participation in this project is voluntary and you are under no obligation to give consent to participate. All participants have the right to withdraw from the project at any time, for any reason, and with no consequence.

Declaration to participants

If you take part in the study, you have the right to:

- Refuse to answer any particular question, and to withdraw from the study at any time
- Ask any further questions about the study that occurs to you during your participation.
- Be given access to a summary of findings from the study when it is concluded.

Who's responsible?
If you have any questions or concerns about the project, either now or in the future, please feel free to contact either:

Researcher: Rosie Stenersen-Kain
Ph 027 8709 567

Supervisor: Associate Professor Angelika Anderson

Yours Sincerely,
Rosie Stenersen-Kain

Appendix D: Participant Consent Form

UNIVERSITY OF WAIKATO

DIVISION of ARTS, LAW, PSYCHOLOGY & SOCIAL SCIENCES

PARTICIPANT CONSENT FORM

[A completed copy of this form should be retained by both the researcher and the participant]

Research Project: Comparison of Prompting Procedures: Assessing the Efficacy of Video Modelling and Text-Based Prompting Procedures to Teach Technology Skills to a New Zealand-based Elderly Population

Name of participant: ____

I have received a copy of the Information Sheet describing the research project and have been given sufficient time to read it. Any questions that I have, relating to the research, have been answered to my satisfaction.

When I sign this consent form, I will retain ownership of the collected data, but I give consent for the researcher to use the data for the purposes of the research outlined in the Information Sheet. I understand that my identity will remain confidential in the presentation of the research findings.

Please complete the following checklist. Tick [□] the appropriate box for each point.	YES	NO
I have the right to decline to have my results reported at any level.		
I know who to contact if I have any questions about the study in general.		
I understand that the information supplied by me could be used in future academic publications.		
I understand that participation in this study is confidential and that no material, which could identify me will be used in any reports on this study.		
I consent to having my results reported, anonymously, for the purposes of the research outlined in the Information Sheet.		
I wish to receive a summary of the findings		
I consent to relevant information about me (i.e., age, gender, etc) being disclosed by the researcher		
I consent to allowing researchers to observe me		
I consent to the videorecording of these sessions		

I consent to filling out pre and post -experiment questionnaires that will assess my level of confidence with technology, preferred teaching method, and my general views on the experiment		
I consent to engage in the teaching tasks (learning how to complete three tasks on an iPad)		

Participant: ___________________ Researcher: ___________________

Signature: ___________________

Signature: ___________________ Date: ___________________

Date: ___________________ Contact Details: Rosie Stenersen-Kain

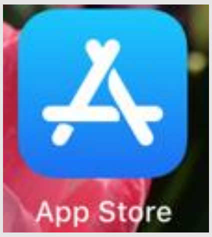
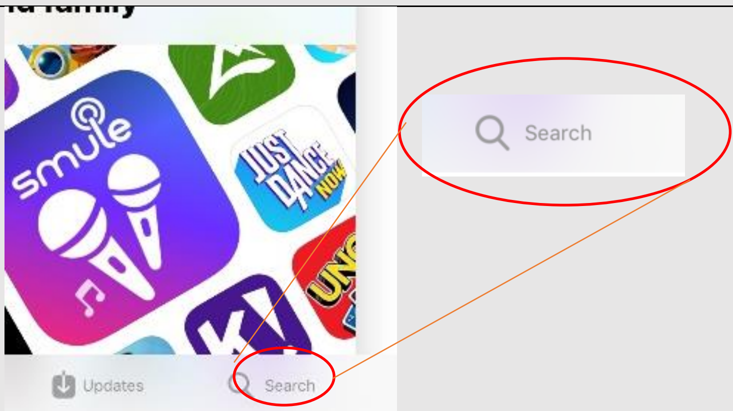
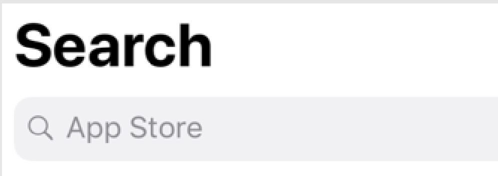
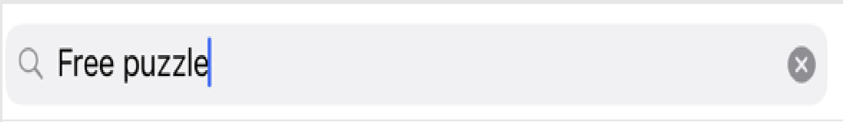
Contact Details: ___________________ Phone: 0278709567

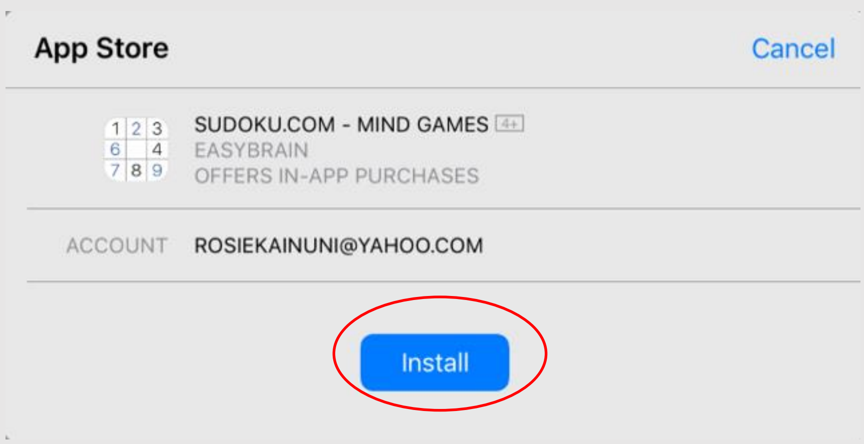
___________________ Email: ors2@students.waikato.ac.nz

……………………………………………

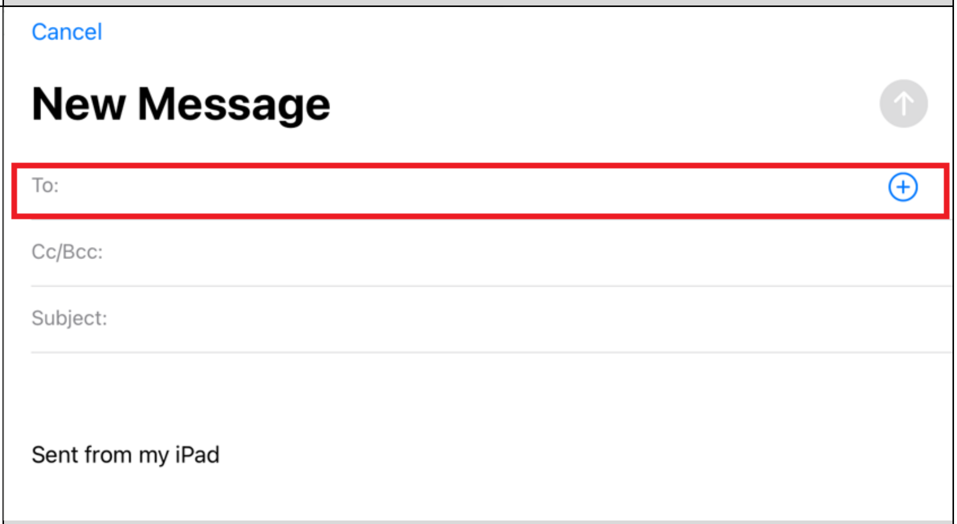
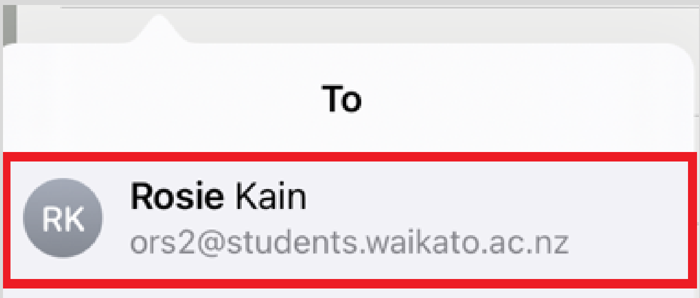
____

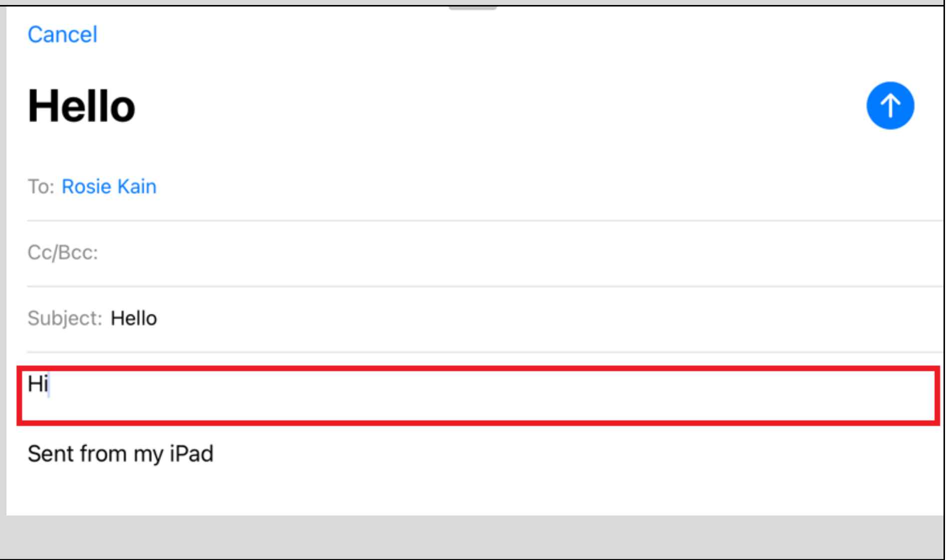
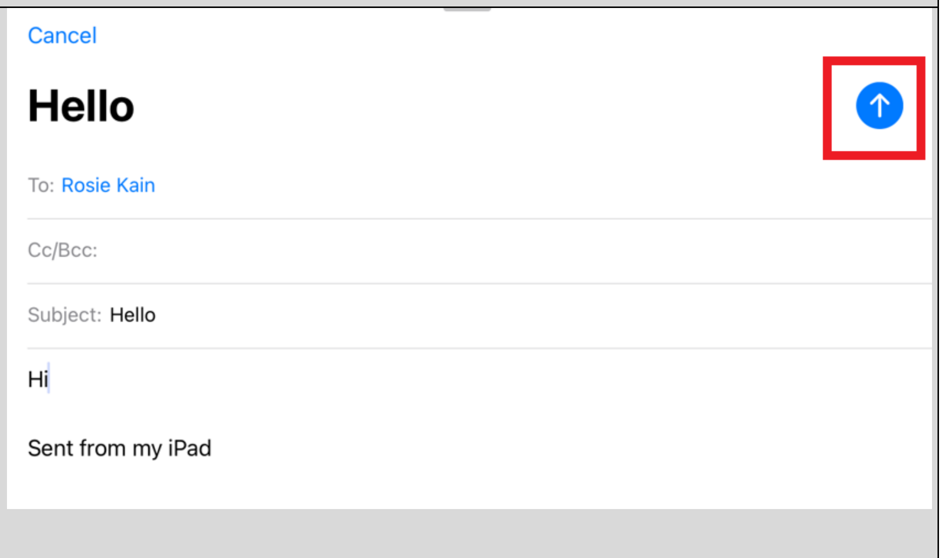
Appendix E: Downloading an Application Text Prompt Sheet

1.	Tap the “AppStore” application	
2.	Tap the “Search” icon at the bottom right corner of the screen	
3.	Tap the search bar	
4.	Type some words that describe the type of application you wish to download e.g., “free puzzle”	

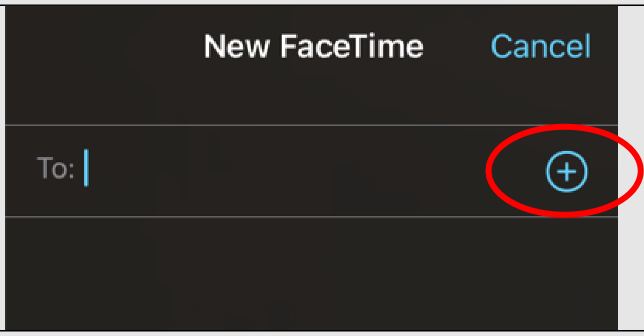
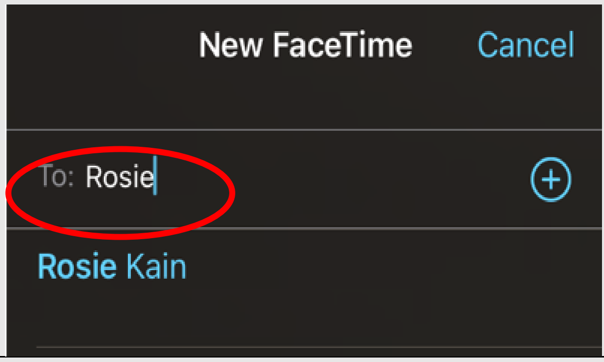
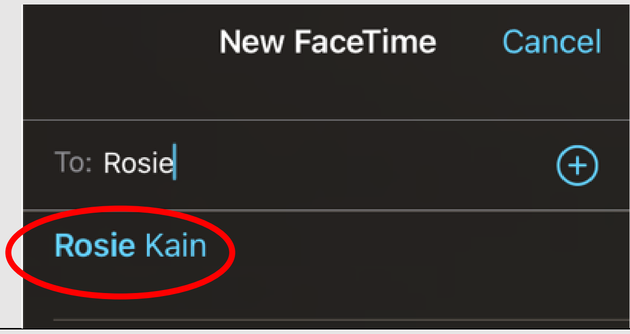
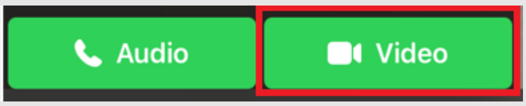
<table>
<tr><td>5.</td><td>Tap the blue “search” icon on the iPad’s keyboard</td><td>
</td></tr>
<tr><td>6.</td><td>Tap the “GET” icon underneath the application’s title</td><td>
</td></tr>
<tr><td>7.</td><td>When the AppStore asks permission to download the application, tap “Install”</td><td>
</td></tr>
</table>

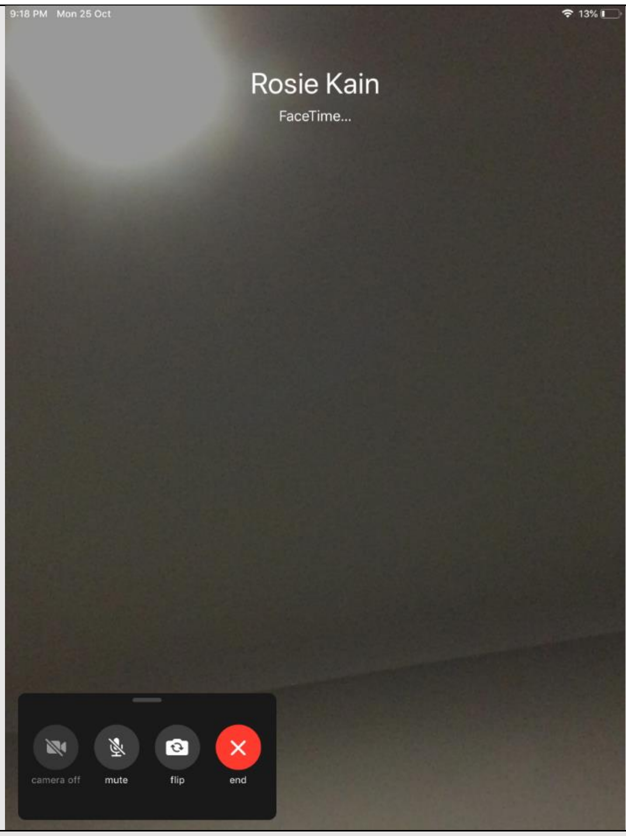
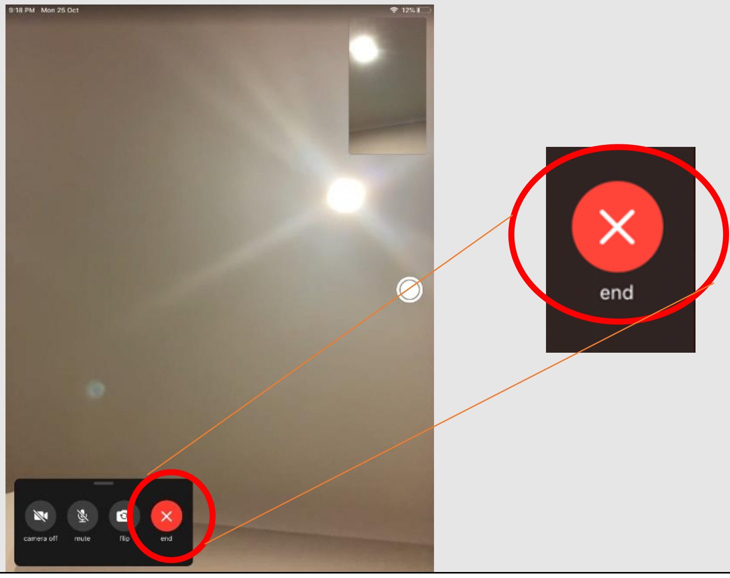
Appendix F: Sending an Email Text Prompt Sheet

1.	Tap the "Mail" application	
2.	Tap the "compose mail" icon on the top right corner of the screen	
3.	Locate the "To:" box and type the name of the person you want to email (Type "Rosie")	
4.	Tap on the name of the person once it appears (Tap "Rosie")	

5.	Tap on the “Subject” box and enter a subject e.g., “Hello”	
6.	Tap in the message box and type your message e.g., “Hi” or “test”	
7.	Tap on the “Send” icon located on the top right corner of the screen	

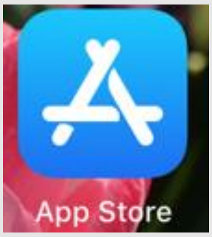
Appendix G: Video calling Text Prompt Sheet

1.	Tap the "FaceTime" application	
2.	Tap the "+" icon at the top right corner of the screen	
3.	Type the name of the person you wish to call (Type "Rosie")	
4.	Tap on the name of the person once it appears (Tap "Rosie")	
5.	Tap the green button that says "Video"	

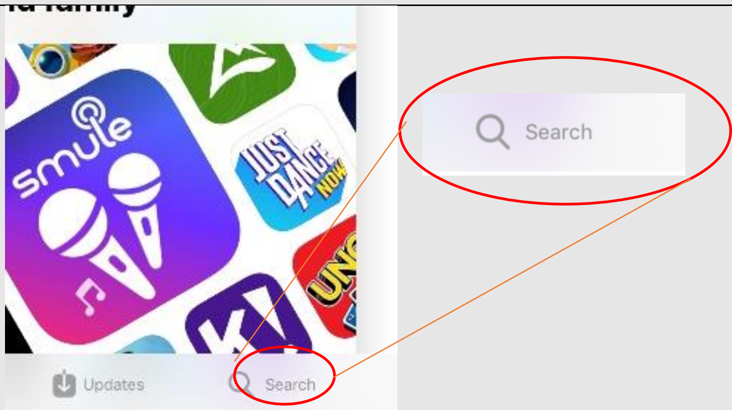
6.	Wait for the researcher to answer the call. Make sure the camera is facing you	
7.	To end the call, tap anywhere on the screen and then tap the red “End” button on the bottom left corner	

Appendix H: Downloading an Application Picture Prompt Sheet

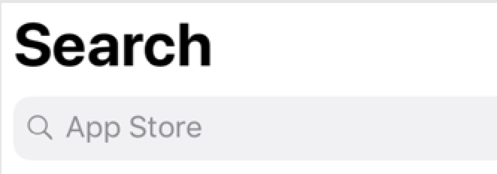
1.



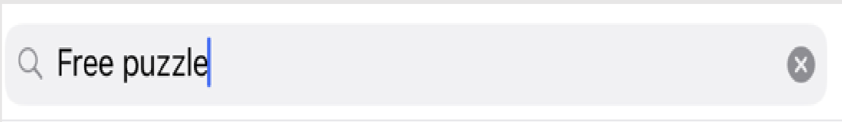
2.



3.



4.

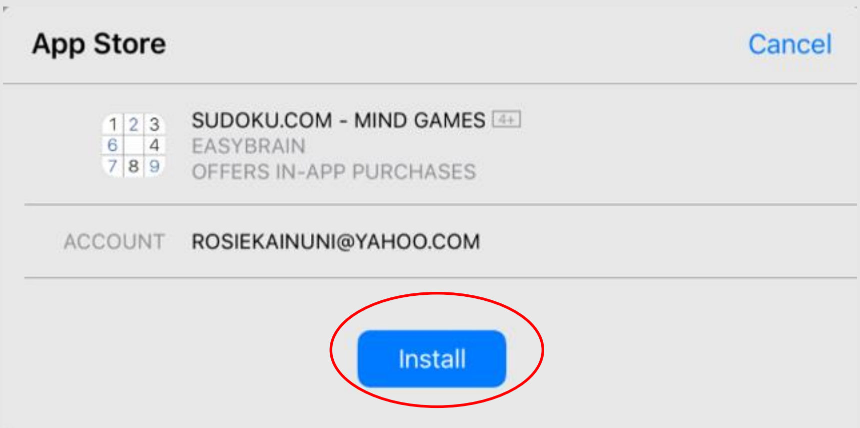


5.

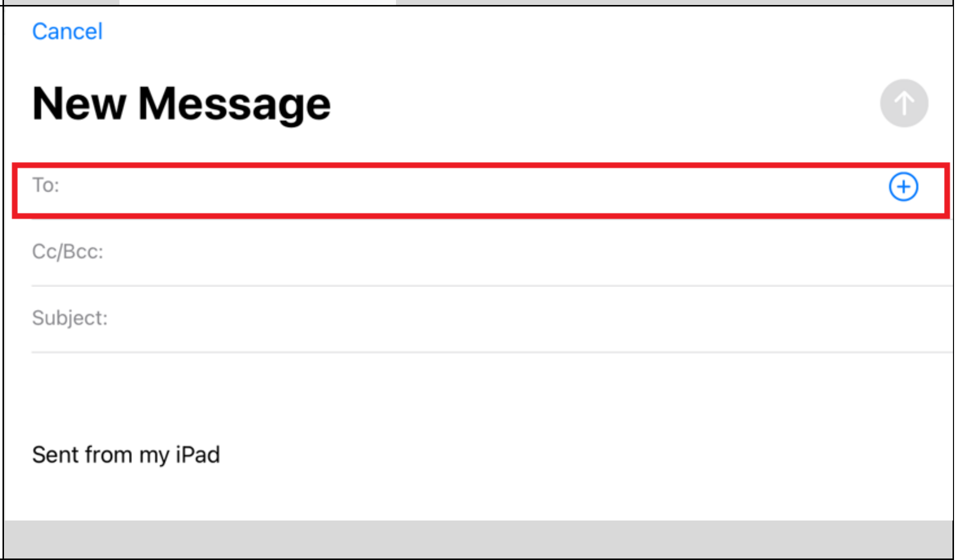
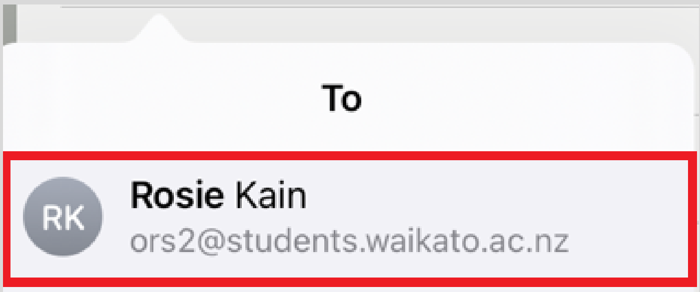
6.

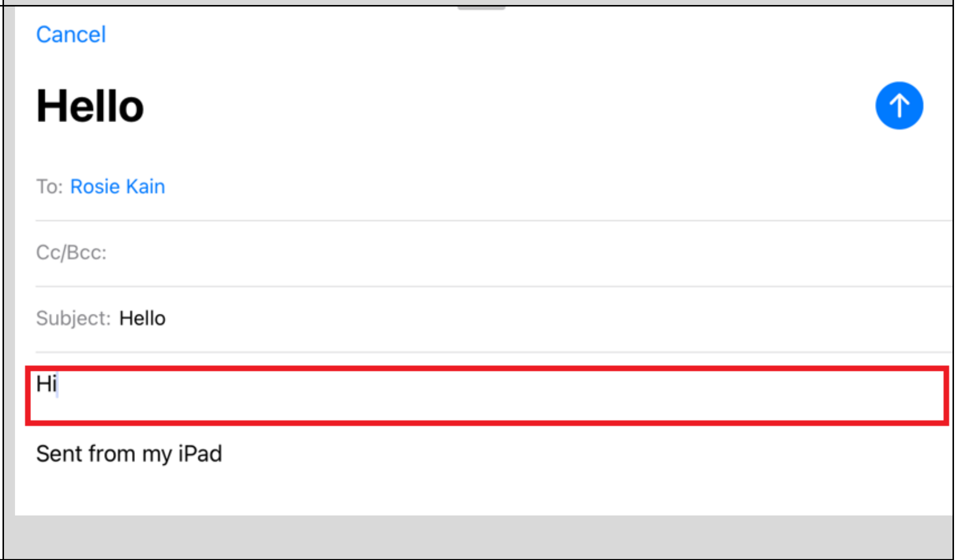
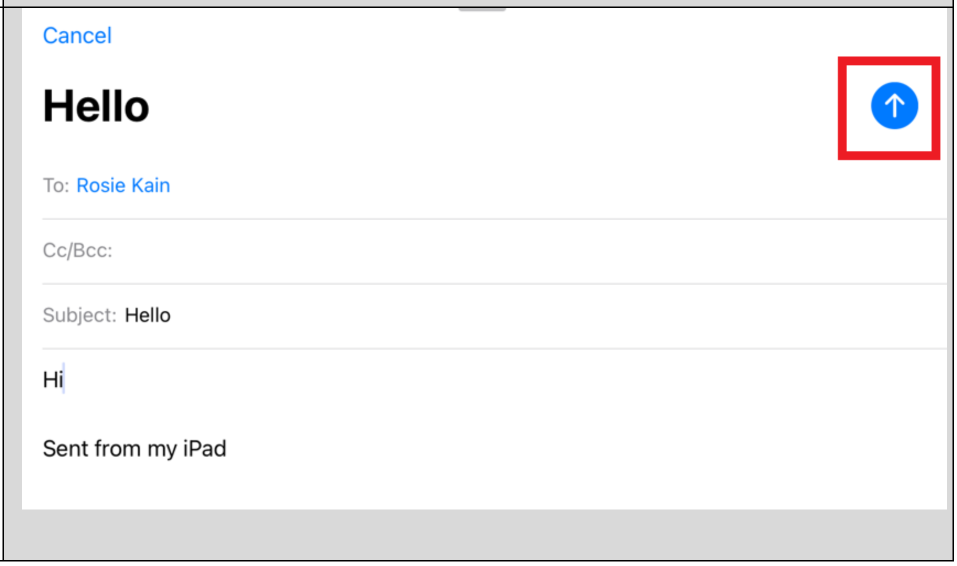

Happy Colour® by N...
Paint by number coloring g...
13.2K
GET
In-App Purchases
COLOR BY NUMBER

7.

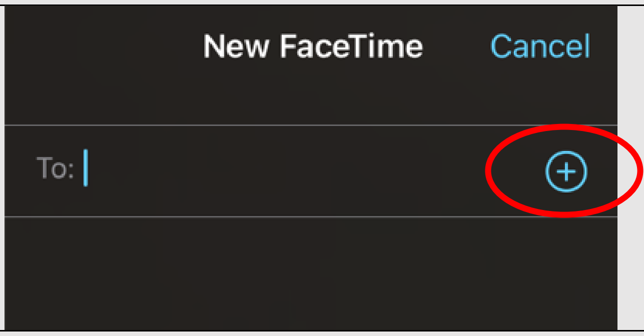
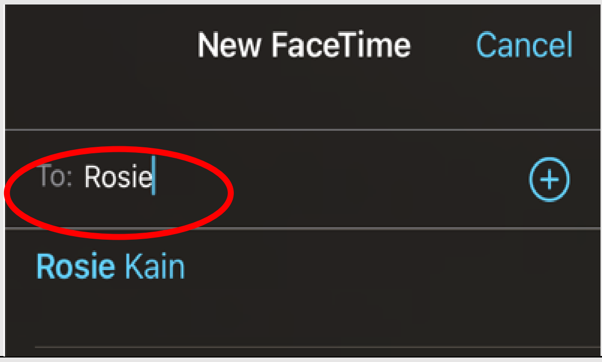
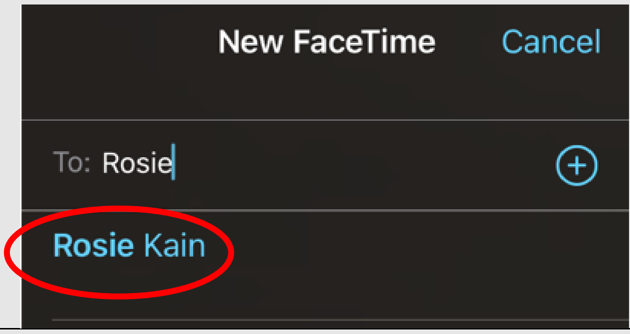
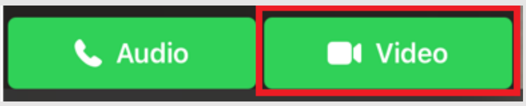

App Store
Cancel
SUDOKU.COM - MIND GAMES
4+
EASYBRAIN
OFFERS IN-APP PURCHASES
ACCOUNT
ROSIEKAINUNI@YAHOO.COM
Install

Appendix I: Sending an Email Picture Prompt Sheet

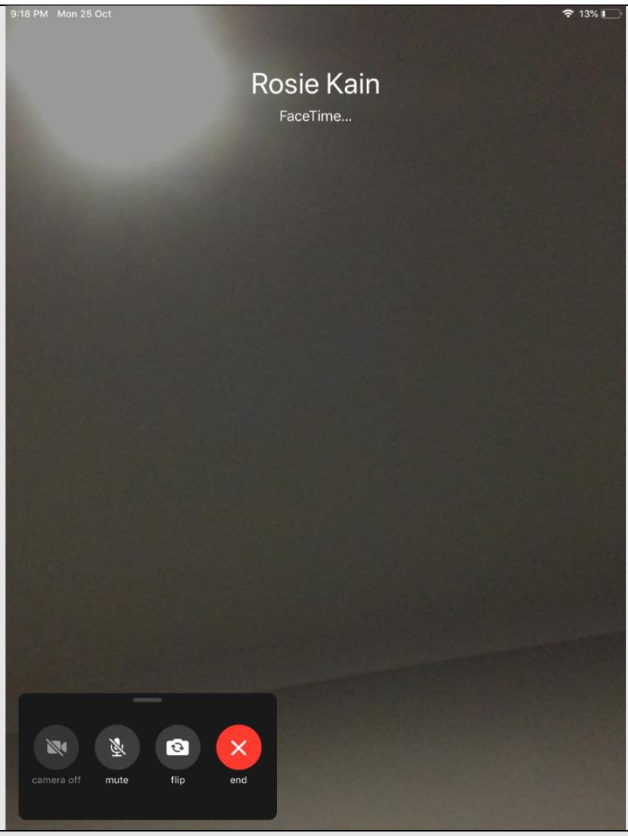
1.	
2.	
3.	
4.	

5.	Cancel Hello To: Rosie Kain Cc/Bcc: Subject: Hello Hi Sent from my iPad
6.	Cancel Hello To: Rosie Kain Cc/Bcc: Subject: Hello Hi Sent from my iPad
7.	Cancel Hello To: Rosie Kain Cc/Bcc: Subject: Hello Hi Sent from my iPad

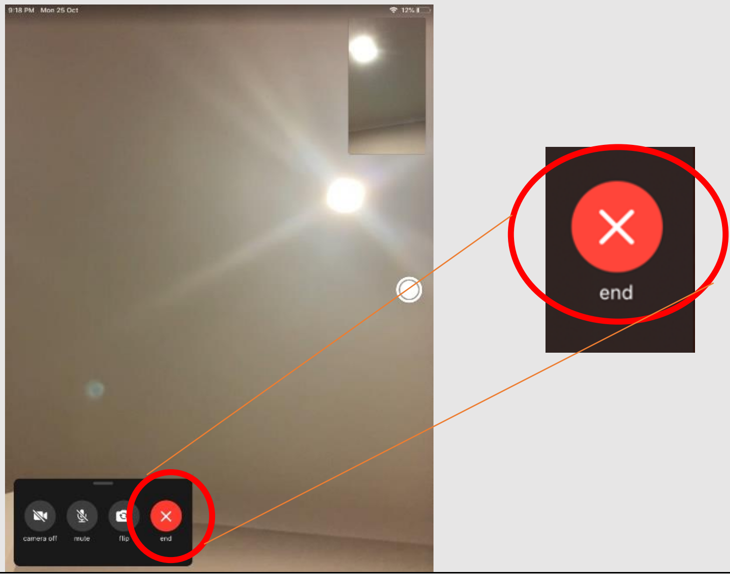
Appendix J: Video Calling Picture Prompt Sheet

<table>
<tr><td>1.</td><td>
</td></tr>
<tr><td>2.</td><td>
</td></tr>
<tr><td>3.</td><td>
</td></tr>
<tr><td>4.</td><td>
</td></tr>
<tr><td>5.</td><td>
</td></tr>
</table>

6.


9:18 PM Mon 25 Oct
13%
Rosie Kain
FaceTime...
camera off
mute
flip
end

7.


9:18 PM Mon 25 Oct
12%
camera off
mute
flip
end
end

Appendix K: Downloading an Application Data Collection Sheet

APP TASK – BASELINE OR ASSESSMENT

Participant ID: Session #: Visit #: Date:

Phase: ~~Teaching~~ / Baseline / Assessment / Follow up / Best-Intervention Condition: Text / Visual / Control

Step	Step completed?	Type of error	Step completed within 10 seconds
1	Tap the "AppStore" application		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
2	Tap the "search icon at the bottom right corner of the screen		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
3	Tap the search bar		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
4	Type some words to describe type of application to download		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
5	Tap the blue "search" icon on the iPad's keyboard		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
6	Tap the "GET" icon underneath the title		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
7	When asked for permission, tap "Install"		
	Y / N	Topographical / Latency / Request for help	Y / N / NR

Steps correct: /7	**Total number of topographical errors:**	**Total requests for help:**	**Total number NR / Latency errors:**

Session terminated: Y / N	Step terminated:	Percent correct responses:

Appendix L: Video Calling Data Collection Sheet

FACETIME TASK – BASELINE OR ASSESSMENT

Participant ID: Session #: Visit #: Date:

Phase: ~~Teaching~~ / Baseline / Assessment / Follow up / Best-Intervention Condition: Text / Visual / Control

Step	Step completed?	Type of error	Step completed within 10 seconds
1	Tap the "FaceTime" application		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
2	Tap the "+" icon at the top right corner of the screen		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
3	Type the name of the person you wish to call (Type "Rosie")		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
4	Tap on the name of the person once it appears (Tap "Rosie")		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
5	Tap the green button that says "Video"		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
6	Wait for the researcher to answer the call. Make sure the camera is facing you		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
7	To end the call, tap anywhere on the screen and then tap the red "End" button on the bottom left corner		
	Y / N	Topographical / Latency / Request for help	Y / N / NR

Steps correct: /7	**Total number of topographical errors:**	**Total requests for help:**	**Total number NR / Latency errors:**

Session terminated: Y / N	Step terminated:	Percent correct responses:

Appendix M: Sending an Email Data Collection Sheet

EMAIL TASK – BASELINE OR ASSESSMENT

Participant ID: Session #: Visit #: Date:

Phase: ~~Teaching~~ / Baseline / Assessment / Follow up / Best-Intervention Condition: Text / Visual / Control

Step	Step completed?	Type of error	Step completed within 10 seconds
1	Tap the "Mail" application		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
2	Tap the "compose mail" icon on the top right corner of the screen		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
3	Locate the "To:" box and type the name of the person you want to email		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
4	Tap on the name of the person once it appears (Tap "Rosie")		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
5	Tap on the "Subject" box and enter a subject e.g., "Hello"		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
6	Tap in the message box and type your message e.g., "Hi" or "test"		
	Y / N	Topographical / Latency / Request for help	Y / N / NR
7	Tap on the "Send" icon located on the top right corner of the screen		
	Y / N	Topographical / Latency / Request for help	Y / N / NR

Steps correct: /7	**Total number of topographical errors:**	**Total requests for help:**	**Total number NR / Latency errors:**

Session terminated: Y / N	Step terminated:	Percent correct responses:

Appendix N: Downloading an Application Teaching Assessment Sheet

APP TASK – Teaching phase

Participant ID: Session #: Visit #:
Date: Phase: Teaching Prompt consumption duration:
Condition: Text / Visual / Control

Step	Step completed? Y / N	Type of error (INC. / Help)
1	Tap the "AppStore" application	
	Y / N	INC. / Request for help
2	Tap the "search icon at the bottom right corner of the screen	
	Y / N	INC. / Request for help
3	Tap the search bar	
	Y / N	INC. / Request for help
4	Type some words to describe type of application to download	
	Y / N	INC. / Request for help
5	Tap the blue "search" icon on the iPad's keyboard	
	Y / N	INC. / Request for help
6	Tap the "GET" icon underneath the title	
	Y / N	INC. / Request for help
7	When asked for permission, tap "Install"	
	Y / N	INC. / Request for help

Steps correct: / 7	**Total number of INC:**	**Total requests for help:**

Session terminated: Y / N	Step terminated:

Appendix O: Video Calling Teaching Assessment Sheet

FACETIME TASK – Teaching phase

Participant ID: Session #: Visit #:

Date: Phase: Teaching Prompt consumption duration:

Condition: Text / Visual / Control

Step	Step completed? Y / N	Type of error (INC. / Help)
1	Tap the "FaceTime" application	
	Y / N	INC. / Request for help
2	Tap the "+" icon at the top right corner of the screen	
	Y / N	INC. / Request for help
3	Type the name of the person you wish to call (Type "Rosie")	
	Y / N	INC. / Request for help
4	Tap on the name of the person once it appears (Tap "Rosie")	
	Y / N	INC. / Request for help
5	Tap the green button that says "Video"	
	Y / N	INC. / Request for help
6	Wait for the researcher to answer the call. Make sure the camera is facing you	
	Y / N	INC. / Request for help
7	To end the call, tap anywhere on the screen and then tap the red "End" button on the bottom left corner	
	Y / N	INC. / Request for help

Steps correct: / 7	**Total number of INC:**	**Total requests for help:**

Session terminated: Y / N	Step terminated:

Appendix P: Sending an Email Teaching Assessment Sheet

EMAIL TASK – Teaching phase

Participant ID: Session #: Visit #:

Date: Phase: Teaching Prompt consumption duration:

Condition: Text / Visual / Control

Step	Step completed? Y / N	Type of error (INC. / Help)
1	Tap the "Mail" application	
	Y / N	INC. / Request for help
2	Tap the "compose mail" icon on the top right corner of the screen	
	Y / N	INC. / Request for help
3	Locate the "To:" box and type the name of the person you want to email	
	Y / N	INC. / Request for help
4	Tap on the name of the person once it appears (Tap "Rosie")	
	Y / N	INC. / Request for help
5	Tap on the "Subject" box and enter a subject e.g., "Hello"	
	Y / N	INC. / Request for help
6	Tap in the message box and type your message e.g., "Hi" or "test"	
	Y / N	INC. / Request for help
7	Tap on the "Send" icon located on the top right corner of the screen	
	Y / N	INC. / Request for help

Steps correct: / 7	**Total number of INC:**	**Total requests for help:**

Session terminated: Y / N	Step terminated:

Appendix Q: Pre-Experiment Questionnaire

Pre-experiment Questionnaire

Name: ______________________________

_ Age: ______________________________

___

Ethnicity: ______________________________

Occupation (if retired, what was your past occupation): ______________________________

_____ __

How confident do you feel using technology (e.g., computers or iPads)?

LEAST CONFIDENT 1 2 3 4 5 MOST CONFIDENT

How often do you use technology?

a) Less than once a month
b) Once or twice a month
c) Once a week
d) Every few days
e) Every day
f) Multiple times a day

How do you like to receive news and current affairs?

a) Newspaper
b) Television
c) Radio
d) Internet websites
e) Other (please state):

How do you prefer to learn?

a) Written instructions
b) Videos
c) Someone teaching me
d) Other (please state):

Do you have any prior experience with technology?

- Yes (please state):
- No

____

_____ ______________________________

Researcher to fill out:

Is participant able to: YES
NO

- Read font
- Hear the video comfortably
- Manipulate fingers/hands

Appendix R: Post-Experiment Questionnaire

Post-experiment Questionnaire

Name: ____

After the experiment, how confident do you feel using technology (e.g., computers or iPads)?

LEAST CONFIDENT 1 2 3 4 5 MOST CONFIDENT

After the experiment, how often do you use technology?

a) Less than once a month
b) Once or twice a month
c) Once a week
d) Every few days
e) Every day
f) Multiple times a day

Which prompting procedure did you like best?

- Video prompting - Text prompting

Would you use this preferred method again to learn a new skill?

- Yes - No

Which prompting procedure did you find easiest to use?

- Video prompting - Text prompting

How easy did you find video prompting?

NOT VERY EASY 1 2 3 4 5 VERY EASY

How easy did you find text prompting?

NOT VERY EASY 1 2 3 4 5 VERY EASY

How helpful was the video prompting?

NOT VERY HELPFUL 1 2 3 4 5 VERY HELPFUL

How helpful was the text prompting?

NOT VERY HELPFUL 1 2 3 4 5 VERY HELPFUL

How useful or relevant were the tablet-based tasks?

a) Sending an email

NOT VERY RELEVANT/USEFUL 1 2 3 4 5 VERY RELEVANT/USEFUL

b) Video calling

NOT VERY RELEVANT/USEFUL 1 2 3 4 5 VERY RELEVANT/USEFUL

c) Downloading an application

NOT VERY RELEVANT/USEFUL 1 2 3 4 5 VERY RELEVANT/USEFUL