Immersive Video Modelling: A Mixed Methods Evaluation of a Life Skills Intervention in a Specialist Secondary Setting

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Abstract

This thesis introduces and evaluates immersive video modelling (IVM), a new intervention that draws upon techniques used in video modelling whilst incorporating virtual reality. IVM uses 360° video to create virtual environments that depict a target skill being carried out. Participants watch 360° videos through a head mounted display with the anticipation that they will be able to learn the skill through watching this video. Videos are recorded from a first-person perspective to enhance feelings of presence (feeling like you are in the video).

This study used IVM to teach a life skill to five participants in a year 9 class at a generic special school. Participants chose to learn how to tie shoelaces. A mixed methods research design was used, consisting of quantitative and qualitative phases. The quantitative phase used an AB design to evaluate the impact that IVM had on shoelace tying skill. One participant was able to master, maintain, and generalise the skill, while the remaining participants failed to do so. The qualitative phase used semi-structured interviews to gather the views of adults who delivered the intervention. Thematic analysis of the interviews found that, overall, participants valued the use of IMV stating that it appeared to increase motivation and engagement. Furthermore, staff were interested in continuing to use 360° video in other ways. However, they raised some concerns about the structure of the intervention and the techniques used to tie shoelaces, which they felt contributed to the limited progress made by some participants. This study concludes that IVM and 360° video appear to offer a number of potential benefits to educators that should continue to be explored in future research.

Dedication

For **Faye**, my soon to be wife, without whom this thesis would remain unwritten. You believed in me when I didn't believe in myself and for that I will be forever grateful. I hope that I can repay the sacrifices of the last three years as we embark on the next leg our journey together. Here's to the future.

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Finally, I would like to offer my biggest thanks to the children who took part in this research and their parents. Without them this research would not have been possible. The students worked very hard throughout the research for which I am hugely grateful.

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List of abbreviations

ADHD	Attention Deficit Hyperactivity Disorder
ASC	Autism Spectrum Condition
CAVE	Cave Automatic Virtual Environments
CTML	Cognitive Theory of Multimedia Learning
DLS	Daily Living Skills
EPs	Educational Psychologists
FOV	Field of View
HMD	Head Mounted Display
IVM	Immersive Video Modelling
PVM	Point-of-view Video Modelling
SCED	Single Case Experimental Design
SEND	Special Educational Needs and Disabilities
SLD	Severe Learning Difficulties
VABS3	Vineland Adaptive Behaviour Scales 3rd Edition
VE	Virtual Environment
VM	Video Modelling
VR	Virtual Reality
VSM	Video Self Modelling

Chapter 1 - Introduction

1.1 Context

This piece of research constitutes the first volume of a two-volume thesis, completed as part of an Applied Educational and Child Psychology Doctorate at The University of Birmingham. It was compiled during the final two years of my study whilst on placement with a Local Authority in the West Midlands.

1.2 Background

This study investigated a means to support the development of life skills in schools. I conducted a literature review of video modelling (VM) and the use of virtual reality (VR) in education to investigate the viability of these approaches when used to teach life skills. Both approaches offered unique benefits that I wished to harness. This culminated in the design of 'immersive video modelling' (IVM). IVM is an intervention that presents individuals with a 360° video of a life skill being carried out. Videos are presented through the use of a head mounted display (HMD) to increase participants' feelings of presence within the video (i.e. feeling like they are part of the video), which, in turn should increase concentration (Rupp et al., 2016). Videos are recorded from a first-person perspective to further enhance feelings of presence and provide participants with an understanding of what carrying out this skill would look like from their perspective. First-person videos have been found to be an effective means of teaching skills through video (Mason, Davis, Boles and Goodwyn, 2013) and, in some circumstances, are more effective than the use of third-person videos (Guta, 2015).

The IVM intervention used in this study draws on evidence-based approaches to instruction. Systematic instruction (Snell, 1990) was used to provide structure to the intervention in a way that aligned with evidence-based principles (Collins, 2012).

Furthermore, the use of the Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2005) allowed videos to be presented in the most optimal way so as to promote learning.

1.3 Rationale

In a previous role, I worked with a large number of children with special educational needs and disabilities (SEND) who were transitioning away from formal education. It was apparent during this time that many of these children left school without the valuable life skills required to be able to live as independently as possible. Academic literature also notes that support for the development of life skills can be overlooked in schools (Douglas and Hewett, 2014). During review meetings school staff often emphasised the importance of the academic curriculum and cited several challenges involved in providing life skills education, including staff skill, time, and providing young people with access to safe environments within the community. Similar barriers were observed by Cullinane and Montacute (2017). In an attempt to overcome these barriers, I sought a technological solution that allowed individuals to begin to acquire life skills in novel settings without having to leave the school site. VR devices allow individuals to experience environments without actually being there, and this seemed like a practical means of supporting the development of community-based life skills without having to leave the school grounds.

As part of my practice as a trainee educational psychologist, I value the importance of evidence-based practices, especially practices that outline means of optimising instruction through the use of instructional principles. Therefore, I sought to include evidence-based principles whilst structuring the IVM intervention. This is

apparent through my use of systematic instruction (Snell, 1990) and CTML (Mayer, 2005).

This study aimed to investigate the viability of IVM including its effectiveness and its practicality. Furthermore, the publication of the details of IVM provides a detailed account of its procedures for it to be replicated in the future by other professionals who wish to adopt this approach. This study uses a mixed methods design. The purpose of the quantitative phase is to determine the effectiveness of the intervention while the qualitative phase aims to explore teachers' views regarding the delivery of the intervention.

Beyond my own preferences, there were several reasons for the evaluation of IVM as part of this thesis. These reasons are described in Chapter 2, but they can be summarised as follows:

- There are currently 5 studies that examine the application of 360° video in educational settings. All of these studies took place in universities and none of the participants had SEND.
- To my knowledge, here are currently no studies that examine the use of 360° video to teach life skills.
- Research into VM focuses on the delivery of the approach and fails to explicitly describe how to structure an intervention based upon evidence-based principals (such as those outlined in systematic instruction).
- Research into the use of HMDs in education is of low quality and consequently it is difficult to generalise the findings of these studies, (Jensen and Konradsen, 2018).

Chapter 2 - Literature Review

2.1 Introduction

This chapter begins by considering the importance of independent living skills and how they are taught to children with SEND, as well as some of the issues associated with this. Next, VM is introduced, and an overview of the literature in this area is considered, including key terms and procedures. This is followed by an exploration of the use of VR in education including key terms and theory that underpin the use of VR in education. Finally, a systematic review of the uses of 360° video in education is carried out and current evidence and practice in this area are considered. This chapter ends by outlining the rationale for IVM and the research questions that this study aims to address.

2.2 Life Skills

Life skills are broadly defined as “skills required for daily life in the community”(Dever, 1988, p.7) and they are skills that are essential for an individual to be able to function independently within society. These skills can relate to: self-care and domestic living, recreation and leisure, social interaction, employment, and community participation (Clark, Field, Patton, Brolin and Sitlington, 1994). While most children are able to develop these skills independently as part of their typical development, some groups require additional support to allow them to learn these skills, for example, children with ASCs (Duncan and Bishop, 2015), physical disabilities (Roebroeck, Jahnsen, Carona, Kent and Chamberlain, 2009) or children with learning difficulties (Shah, 2017). Therefore, it is essential that educators provide additional support to individuals with these needs to ensure that these young people are able to develop their life skills to maximise their ability to be independent.

Traditionally, Educational Psychologists (EPs) have not worked with young people entering this phase of their education. However, following the Children and Families Act (2014), EPs now work with young people up to the age of 25. This has required EPs to extend their existing competencies (Atkinson, Dunsmuir, Lang and Wright, 2015). Legislative changes have increased the focus on preparation for adulthood from year 9 onwards (DfE and DoH, 2015) and emphasised the importance of working towards positive outcomes relating to independent living, community inclusion, employment, and health (Department for Education/ Preparation for Adulthood, 2017). These domains closely resemble those put forwards by Clark et al. (1994) and therefore underline the importance of EPs working towards supporting young people to develop life skills. However, It has been highlighted that the work of EPs within this area is not currently evidence-based, and there is limited research to demonstrate how EPs can improve outcomes within the post-16 sector (Morris and Atkinson, 2018), indicating that this is an important area for research.

Furthermore, McLinden, Douglas, Cobb, Hewett and Ravenscroft (2016) emphasise the importance of a school's role in supporting children to acquire skills that allow them to access post-school life with higher levels of independence. Despite this, it is noted that this important instruction is often overlooked in schools (for example Douglas and Hewett, 2014, highlight how this is the case for children with visual impairments). My observations made during my practice as a trainee educational psychologist support this assertion in relation to children with a range of SEND including learning needs, communication and interaction needs and physical needs. Additionally, I have observed that there often appear to be a number of practical barriers that prevent this type of support from being put in place. This includes the limited availability of staff, difficulties accessing the environment required to practise

skills, and time. Many of these skills can only be practised in the community; for example, buying an item from a shop, crossing a road, or using an ATM machine. Digital technology offers a means of addressing some of these barriers as it allows individuals to experience being in the community without having to leave the school grounds (Chen, 2006).

Despite the barriers that make putting this support in place challenging, there are a number of studies that have examined life skill instruction. Alwell and Cobb (2009) conducted a meta-analysis of functional life skills interventions for young people with SEND. They noted a number of studies that described intervention that resulted in positive life skills outcomes and they concluded that life skills instruction is effective. However, they also found that there was a great deal of variation between intervention procedures, with many the majority of studies using bespoke procedures, thus making any synthesis of the data impossible. Similarly, the needs of participants were also very varied which further added to the challenge in synthesising findings. More recent analysis has grouped interventions by type to allow cleared synthesis. Hong et al. (2015) grouped life skills interventions for young people with ASCs based upon the means of delivery to allow clearer comparison. They identified four ways of delivering life skills instruction: video modelling, in-vivo modelling, audio cues and visual cues. This study concluded that only video modelling met the criteria for evidence based practice (Horner, 2005). Consequently, video modelling currently has the most robust evidence based compared to other means of teaching life skills to children with ASCs.

While there are a number of individual studies that examine the efficacy of life skills interventions, there have been few attempts to synthesise this research, with Alwell and Cobb (2009) and Hong (2015) proving two notable exceptions. However, it

must be noted that due to the broad and ill-defined nature of 'life skills' there are other reviews that examine elements of life skills (such as Shukla-Mehta, Miller and Callahan's, 2010 review of using video modelling to teach social communication skills). These reviews may provide evidence of effective intervention for individual elements of life skills, however, as they do not consider all elements of life skills (as outlined by Clark et al., 1994) and they have been omitted from this section.

2.3 Uses of Modern Technology in Education and Potential Barriers

The use of technology in education is outlined as an area of growth that is actively being invested in by education policy makers (DfE, 2019). As technology becomes more ubiquitous within daily life, this trend is beginning to translate to education, with technologies such as digital whiteboards and computer based presentations becoming the norm in UK classrooms. Despite these changes, there is limited evidence to show that the adoption of technology has resulted in improved outcomes (Blackwell, Lauricella, Wartella, Robb and Schomburg, 2015).

However, there are a number of examples of the successful application of technology for children with SEND. For example, computer based instruction, such as Lexia Reading, has been suggested to be an effective means of remedial intervention (Brooks, 2016). Likewise, the use of devices such as reading pens and text to speech software have been found to have a significant improvement on reading comprehension (Higgins and Rashkind, 2004; Moorman, Boon, Keller-Bell, Stagliano and Jeffs, 2010). Similarly, specialist settings have used technological developments such as switches, eye-tracking technology and child led sensory rooms to increase student empowerment and communication (DfE, 2019). These examples provide an introduction to the potential benefits that technology can offer to the education of children with SEND.

Outside of education, the benefits of using technology have been seen through increases in productivity and efficiency (Lim, Zhao, Toudeur, Chai and Tsai, 2013). However, the same scale of change is yet to be witnessed in education (Blackwell, el al., 2015). Lim et al. (2013) highlight that the successful introduction of new technology is often accompanied by an organisational change such as a change in process and culture, and therefore, the success of new technology is dependent upon the context in which they are used. Venkatesh, Morris, Davis and Davis, (2003) offer further insight into these contextual factors through the proposal of the unified theory of acceptance and use of technology. This theory proposes that there are four key influences on whether technology is adopted:

1. Performance expectancy- this refers to the extent that the individual believes that the use of technology will result in positive outcomes. The higher the level of performance expectation, the more likely the person is to use the technology.
2. Effort expectancy- this refers to the amount of perceived effort the use of technology will require. Participants are more likely to adopt new technologies if they perceive that it will require lower levels of effort to adopt.
3. Social influence- this refers to the social norms regarding technology within the organisation and whether or not these norms are conducive to change or adopting new technology
4. Facilitating conditions- this refers to the level of support available to allow the adoption of new technology and includes training and technical support.

This model has been found to offer high levels of predictive validity regarding technology use as it has been found to explain 70% of variance in the intention to use technology and 50% of the variance in actual technology use (Venkatesh, Thong and Xu, 2012). Furthermore, it has been successfully applied in educational research, demonstrating its appropriateness within this field (Blackwell, Lauricella, Wartella, Robb and Schomburg, 2015). Consequently, this theory outlines a number of areas that need to be considered when implementing new technology and it outlines a number of potential barriers that should be addressed to support implementation of new technologies.

Elsewhere, the use of technology has been suggested to have a negative impact upon students' performance. The use of laptops, have been found to offer increased distraction. In a phenomenological analysis, Aagaard (2015) reported that students and teachers felt that technology was a distraction, especially to individuals who struggled to access taught content. Furthermore, habituated patterns of technology use from the outside the classroom influenced the way in which participants engaged with technology, for example, many children instinctively opened Facebook and switched between this and the learning task. Consequently, the way in which users interface with technology outside of the classroom is likely to impact on how they use that technology in the classroom. This has potential implications on attention and on task behaviour.

In summary, there is some evidence that the use of specific modern technologies can improve outcomes within certain domains, including for children with SEND (for example technologies that support children with reading difficulties). However, there are a number of factors that influence the adoption of these technologies. Both extrinsic and personal factors can influence how likely a member

of staff is to adopt the use of new technologies, as outlined by the unified theory of acceptance and use of technology (Venkatesh, 2003). Additionally, there is some evidence to suggest that the outcomes from using technology may not always be positive, for example, Aagaard's (2015) findings that the use of technology can serve as a distraction in the classroom.

2.4 Video Modelling (VM)

Modelling is a concept derived from the work of Albert Bandura. In their seminal paper, Bandura, Ross, and Ross (1961) found that participants were able to acquire behaviour from watching the actions of others (referred to as models). This deviated from the traditional behaviourist principles that reinforcement and punishment were responsible for behaviour change (as suggested by Skinner, 1948). VM draws upon this concept, hypothesising that presenting an individual with a video of a model carrying out a behaviour will result in them acquiring the modelled behaviour.

VM has an expanding evidence base, especially for its use with children with Autism Spectrum Conditions (ASCs) for whom it is considered an evidence-based practice (Bellini and Akullian, 2007). Likewise, it is recommended as an effective strategy for teaching skills to children with ASCs (NICE, 2013). It is believed that VM's highly visual nature aligns with the visual strengths commonly found in individuals with ASCs, thereby offering some explanations as to its effectiveness (Mason et al., 2013). Elsewhere, Sng, Carter, and Stephenson's (2014) systematic literature review compared the efficacy of VM and verbal scripts when used to teach conversation skills to children with ASCs (verbal scripts are a prompting strategy that can be used to encourage children to initiate key stages of communication). This review allowed VM

to be compared to a more established intervention and it was found that both interventions resulted in comparable improvements in social skills.

As part of this thesis, I conducted a weight-of-evidence review of the applications of VM for teaching social skills to children with ASCs (see volume 2 of this thesis for this review). This review identified a number of methodological limitations within the literature, including small sample sizes, a lack of matched control groups, variations in the way that the interventions were delivered, and the heterogeneity of the participants and skills taught. Furthermore, Bellini and Akullian (2007) and Sng et al. (2014) reported similar limitations during their systematic reviews. Most notably, Sng et al. (2014) reported that other approaches, such as prompting, were included in some VM interventions. Prompting is not considered part of a VM intervention (Shukla-Mehta, Miller and Callahan, 2010), and it is likely that prompting will improve performance, which threatens the validity of these studies.

A review by Shukla-Mehta et al. (2010) offered a more nuanced description of VM, describing it as an umbrella term that consists of three separate approaches: video modelling, video self-modelling (VSM) and point-of-view video modelling (PVM). They describe Video Modelling as an intervention that requires the participant to watch a video of a competent model performing a task from a third-person perspective before being asked to complete the task themselves. VSM is a variant of video modelling in which participants are required to watch a video of themselves performing a skill before being asked to perform this skill. VSM is most commonly used to increase the frequency of desirable behaviours (Regan and Howe, 2017; Hart, 2010). PVM is an intervention where the video is recorded from a first-person perspective. Shukla-Mehta et al. (2010) state that PVM may be a more convenient intervention as it allows videos to be recorded as part of everyday practice. PVM has a number of applications and

has been found to be effective in teaching food preparation skills (Shrestha, Anderson, and Moore, 2013), recognising and writing Arabic numerals (Jowett, Moore, and Anderson, 2012), and increasing prosocial behaviour during classroom transitions (Schreibman, Whalen and Stahmer, 2000). Furthermore, it has also been found to be more effective than third-person modelling approaches at teaching the appropriate use of pronouns (Guta, 2015). In a review of PVM literature, it was found to have an overall effect size of .78 (Mason et al., 2013), indicating that it has a medium positive effect on target behaviour (Cohen, 1988). Mason et al. also found that PVM was slightly more effective when used with children with ASCs, establishing a large positive effect (effect size = .81) compared to children with other developmental disabilities who only experienced a medium positive effect (effect size= .72). It also has the strongest effect sizes with older students (11-17, years effect size=.79, 18+ years effect size=.85) thereby demonstrating its value with older individuals. Mason et al. (2013) concluded that PVM appears to be an effective intervention, especially for supporting the development of independence skills in post-16 education. They also concluded that PVM meets the criteria for evidence-based practice, as outlined by (Horner et. al., 2005).

Additionally, PVM may offer some practical benefits over other modelling approaches, since its first-person presentation is a truer reflection of the real-life experience of performing a task. Consequently, it may be easier for a child to generalise what they see into real life (Mason et al., 2013). However, one potential limitation of this approach is the field of view available to conventional means of recording. Due to the close proximity of the camera to the model's body, it is not possible to fit all relevant features of the activity into the camera's field of view (FOV) (such as the model's hands). This is a barrier to making a PVM video with traditional

camera equipment. However, viewing tasks from a first-person perspective is common practice in interventions that use VR. This is because VR-based interventions offer a 360° FOV that overcomes this limitation by ensuring that all salient information is accessible to an observer. With the increased accessibility of VR and 360° video, it appears that the use of these tools may overcome the difficulties that make PVM challenging. 360° video is a form of VR (Kavanagh, Luxton-Reilly, Wüensche and Plimmer, 2017) and, therefore, it is important to examine how VR has been applied within education.

2.5 Virtual Reality

2.5.1 An overview of virtual reality. While a seemingly modern concept, the first use of VR was in 1966 (Kavanagh et al., 2017). Since then, technological developments have increased the accessibility, affordability and prevalence of VR. In fact, the prevalence of VR is expanding rapidly, with 66% of young people having used VR (Mannion, 2018). The industry is growing substantially, and its value is expected to surpass a trillion dollars by 2035 (Citibank, 2016). Therefore, it appears that the use of VR is already becoming widespread, and this trend is expected to continue, thus positioning it as a tool that could potentially be used more widely by educators.

However, VR is a broad term and is defined as follows:

> "…a computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors" (Oxford Online Dictionary, 2018).

The breadth of this definition encompasses a number of technologies, including: HMDs, immersive rooms, Kinect-based systems and 2D screen-based VR. Table 1

summarises the characteristics of these approaches and highlights the fact that there are a number of different ways of presenting VR that are significantly different. Some of these approaches surround participants in a virtual environment through the use of immersive rooms or HMDs, while others present the environment using a more traditional screen-based display. Likewise, the nature of interaction also differs, with some of these approaches using a mouse and keyboard, while others use gesture control or head movement to influence the environment. Furthermore, there is no agreed procedure for using these approaches, resulting in diversity in terms of their application, which has made it challenging to synthesise research findings to determine the efficacy of differing approaches to VR (Miller and Bugnariu, 2016).

Table 1. *Different ways of presenting VR*

VR presentation device	**Description of approach**
Head mounted displays (HMDs)	Head mounted displays require participants to wear VR goggles that adjust the field of view in response to the participants head movements. These approaches can sometimes be combined with other feedback devices such as haptic gloves that allow a virtual representation of the participant's hands to be seen in the VR
Immersive rooms	Immersive rooms such as Cave Automatic Virtual Environments (CAVE) place users in a room that has projections of a virtual environment on all sides, surrounding them in VR without the need for goggles.
Kinect based systems	Kinect based systems are used to record a user's movements using the Xbox 360 Kinect sensor. This then projects user's movements into a Virtual Environment, allowing them to interact with the environment or see their image within the environment.
Screen based displays	Screen based displays allow users to view VR through a traditional computer screen or TV. Participants can often navigate this environment using a touch screen, keyboard and mouse or controller.

In an attempt to provide greater clarity about how approaches to VR differ, Milgram et al. (1995) proposed a Virtual Reality Continuum that aims to establish the

difference between a number of approaches to virtual reality (see Figure 1). This continuum extends from the lowest level of virtual integration, and moves to the highest levels of integration. It starts with a real environment; this is an environment with no computer-generated influence. Augmented reality is further along the continuum because it is a digital image mapped onto a real-time environment, such as an image overlaid onto a camera display. Augmented vitality is similar to augmented reality, however the user is able to interact with the augmented images through being able to reach out into the image to grab or manipulate virtual items within the camera display. Finally, a virtual environment (VE) is an entirely simulated reality. This continuum demonstrates the diversity within VR. The present study examines the use of VE and, therefore, the remainder of this literature review will focus on the application of VEs unless otherwise stated (the term VR will be used to refer to the entire VR continuum, while the term VE will refer to VEs specifically).

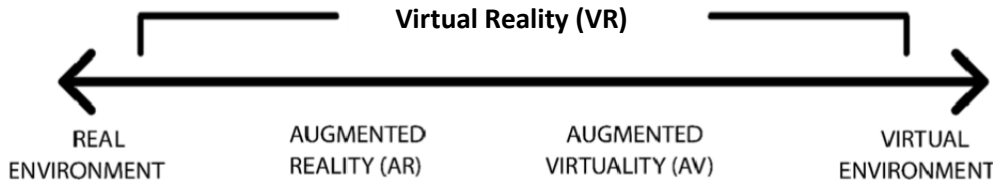


Figure 1. The virtual Reality Continuum (Milgram et al.,1995).

While Milgram et al.'s (1995) distinction provided a useful way of separating VE from augmented environments, it does not provide clarity regarding the diversity of VEs in use. One of the most useful means of distinguishing between VEs is the levels of immersion they provide. Immersion refers to the extent to which sensory input from

the real world is translated to a virtual input, such as visual inputs, and proprioceptive input, such as body movements (i.e. being able to look around a VE by turning your head). Immersion is increased by using different forms of equipment; it is an objective and technological concept. Slater and Wilbur (1997) argue that the level of immersion is dependent upon five components: inclusion, extensive, surrounding, vivid and matching, which are described in Table 2. Miller and Bugnariu (2016) expanded this model to elaborate on levels of immersion through a checklist-based approach. This helps to distinguish between high, moderate, and low levels of immersion within each domain, as well as providing an overall level of immersion.

Table 2. *A description of Slater and Wilbur's (1997) model of immersion as described by Miller and Bugnariu (2016)*

Concept	**Definition**
Inclusive	To what extent the VE eliminates the existence of the physical world (for example, is there external noise or do users have to control the VE though physical devices?)
Extensive	The number of sensory inputs accommodated (for example, visual, auditory, tactile and proprioceptive)
Surrounding	The extent to which the user is surrounded within their field of view i.e. can they see the physical world or is the physical world shut out by a headset?
Vivid	The quality of the presentation of the virtual environment such as the realism of the environment and the resolution of the screen.
Matching	If the viewpoint of the VE matches that of the user's perspective i.e. a third person perspective is less immersive than a first person perspective

While immersion is an objective condition created by technology, presence is the subjective outcome of being immersed in a VE. Presence is described as: "…the extent to which a person's cognitive and perceptual systems are tricked into believing they are somewhere other than their physical location" (Patrick et al., 2000 p.2). Immersion and presence are frequently used interchangeably (Freina and Ott, 2015) and it has been argued that "…immersion *is* presence" (Brown and Cairns, 2004 p.3). However, Slater (2003) argues that increasing immersion will not necessarily produce an expected level of presence. This is supported through research which found that increasing immersion leads to increases of presence overall, but not in all participants (Rupp et al., 2016). Furthermore, Rupp et al., observed that increases in presence correlated with increased engagement and on-task behaviour, thus indicating the value of presence.

2.5.2 Recent technological developments in VR. Although VR is not a new technology, it has only recently started to be applied in educational settings on a larger scale. Until recently VR devices were not available to the majority of the population (Stojšić et al., 2016), users required specialist training and equipment was expensive (Youngblut, 1997). More recent consumer-grade technology has significantly reduced the price, accessibility, and prevalence of VR devices. Computer-based devices, such as the Oculus Rift, offer high-quality VR, but require specialist computer systems to run. Other devices, such as the Samsung Gear VR and Google Cardboard, rely on the use of mobile phones to run VR software as well as acting as the screen for the VR headset. A Bring Your Own Device approach has been used in education so that students can use their own phones to act as VR viewers (Rodriguez, 2016). Furthermore, increased investment from the technology industry has resulted in the production of many programmes that are compatible for use with VR systems.

Mannion's (2018) qualitative analysis of the uses of VR in schools found that teachers have been using VR based apps such as Google Expeditions (this allows children to go on virtual field trips) and Time Looper (this allows individuals to experience what modern day locations looked like in the past). Consequently, recent hardware and software developments has resulted in an increased interest in the use of VR in education. The DfE have recently published "A strategy for education providers and the technology industry", which calls for the UK to become a world leader in the use of technology in education, including the use of VR (DfE, 2019, p.1). This indicates that government policy is also directly influencing the adoption of VR within education.

2.5.3 Uses of VR in mainstream education. Several systematic reviews have been carried out that examine the uses of VR in education. Freina and Ott's (2015) review explored the applications of VR in education and found that the majority of uses were within adult training or university education. They concluded that little has been reported on the use of VR with school age children and even less is known about the applications of VR with children with SEND. However, it must be noted that this review was conducted prior to the production of consumer-grade headsets.

In a more recent review, Kavanagh et al. (2017) conducted a thematic analysis of VR applications in education. Of the 99 papers analysed within this study, only 15% took place within a school-age population, with the majority of research focusing on higher education (51%). This study concluded that the uses of VR within education can be categorised as simulation (giving access to a lifelike world), training (a virtual environment that aims to teach a specific skill), provide access to limited resources (providing access to environments that are otherwise impractical, unfeasible or unsafe to access; such as virtual field trips), and distance learning (being able to experience realistic classroom environments from afar). Kavanagh et al. (2017) also analysed the

pedagogy that underpinned the application of VR in education. The findings were mixed, with constructivism, gamification, collectivism, and pragmatic pedagogies all being cited as the pedagogical foundation of VR. Overall, Kavanagh et al. (2017) demonstrated diversity in the way that VR is used in education.

Elsewhere, Jensen and Konradsen (2018) reviewed the use of HMDs in education and training. HMDs offer a more immersive VR experience. They reviewed 21 studies, and found that the use of HMDs appears to be beneficial as regards to the acquisition of cognitive skills, understanding spatial and visual information, and psycho-motor skills such as observational skills. However, they also found that outside these areas, HMDs offered no improvement in skill acquisition compared to less immersive technology and face-to-face instruction. Additionally, due to the small number of studies and the low quality of research, they were unable to make any generalisations regarding the findings of their study. However, Jensen and Konranson (2018) failed to describe the characteristics of any of the participants in the studies used within the review, and it was not stated which phase of education and training they are in. This makes it unclear as to who these conclusions may apply.

2.5.4 Uses of VR to teach persons with SEND. Through reviewing the literature, it is apparent that there are a limited number of recent studies exploring the use of VR with individuals with SEND. Jeffs (2010) and Standon and Brown (2005) provide comprehensive systematic analyses that demonstrate promising evidence for the application of earlier VR technologies with individuals with SEND. However, more recent systematic reviews indicated that there has been limited research within this domain since 2009. Freina and Ott's (2015) systematic review of the uses of immersive VR in education between 2013 and 2014 only found four papers that related to individuals with SEND. Meanwhile, in a review of papers studying VR in education

published between 2010 and 2017, Kavanagh (2017) found that seven of 125 papers reported on issues relating to learning difficulties. However, further analysis of the review indicates that only two of the papers specifically explore the application of VR with children with SEND. Given the rate at which VR technology has changed in the past decade it appears that there is limited research that explores how these changes apply to individuals with SEND, underlining that this is an area for future research. Despite the limited evidence base, the remainder of this section will summarise the existing research into the application of VEs with children with SEND. This will include older studies due to a lack of recent literature.

VEs have been applied to support children with physical difficulties. Early research aimed to teach wheelchair users mobility and navigation skills that were often costly and time-consuming to teach. Through the creation of VE's, children were able to practise these skills, but it was reported that these environments were of limited use due to how unrealistic the VE's were (Desbonnet, Cox, and Rahman, 1998). However, other studies have found that the use of VE's can lead to real-life improvements in operating a powered wheelchair (Hasdai, Jessel, and Weiss, 1998; Pithon, Weiss, Richir, and Kinger, 2009).

The use of VEs has been found to be beneficial when working with deaf children. Passig and Eden (2003) hypothesised that VEs allow abstract concepts to be presented in a more concrete way that supports the understanding of deaf children. Additionally, the use of VEs has been found to improve the performance of deaf children's on tasks relating to numeracy skills, inductive reasoning, and sequential time perception (Passig and Eden, 2003; Eden, 2008).

Older research demonstrates that VEs have been used to support life skill instruction to children with severe learning difficulties (SLDs). The life skills project (Cobb, Neale, and Reynolds, 1998) aimed to teach young people with SLDs life skills, including getting on a bus, buying food from the supermarket, and going to a café. This study found that the participants enjoyed using the VE and could acquire and transfer the skills obtained in these environments to real-life situations. Similar studies have also reported that young people with SLDs were able to learn and generalise a number of life skills, including shopping in a supermarket (Standen, Cromby and Brown, 1998) and preparing food (Brooks, Rose, Attree and Elliot-Square, 2002). Other research exploring the application of VEs with children with SLDs found that participants were able to increase their vocabulary of Makaton signs though the use of a specially designed VE (Standen and Low, 1996), although, in this instance, a reward system was needed alongside the VE to increase engagement.

Elsewhere, VR has been utilised to assess and rehabilitate individuals with attentional difficulties, such as those associated with Attention Deficit Hyperactivity Disorder (ADHD). Rizzo et al. (2000) used an HMD to present a virtual classroom in which researchers controlled the stimuli presented within the environment. This allowed researchers to determine whether distractions interfered with the participants' ability to complete pre-determined tasks. Through applying this method, it has been observed that individuals with ADHD performed significantly worse on a continuous performance task compared to neuro-typical participants (Negut, Jurma, and David, 2017). Furthermore, assessments using a continuous performance task were found to demonstrate increased ecological validity when delivered through an immersive VE compared to non-virtual methods as they take place in a more natural environment (Yeh, Tsai, Fan, Liu and Rizzo, 2012). In a review of literature in this area, Bashiri,

Ghazisaeedi, and Shahmorad (2017) concluded that VEs offer a number of benefits to children with ADHD, including providing a safe and responsive environment in which to practise skills, providing motivating and engaging environments, and providing a platform to deliver psychological assessments that are more ecologically valid than non-virtual methods.

Furthermore, VEs have been used to develop wayfinding skills in children with Down Syndrome. Purser et al. (2015) presented participants with virtual mazes to determine whether, through repeated exposure, they were able to improve their navigation skills. They found that participants with Down Syndrome were able to learn routes, and individuals with higher non-verbal ability performed comparatively to typically developing participants. However, both typically developing participants and participants with Down Syndrome with low non-verbal ability made significantly more errors compared to those of higher ability. Similarly, Courbois et al. (2013) found that individuals with Down Syndrome were able to learn to navigate routes in a more realistic VE without error. However these skills were not applied to wayfinding in the real world as part of this study.

Recent years have seen an increase in research aimed at to designing VEs that teach skills to children with ASCs. It is suggested that VR may offer a number of unique benefits to individuals with ASCs due to its clear visual presentation of environments that also display spatial relationships (Bozgeyikli, Raij, Katkoori, and Alqasemi, 2018). Lorenzo, Pomares, and Lledo (2013) created a sophisticated VE using motion tracking with an HMD present to children with high-functioning ASCs with a number of social scenarios. It was reported that participants showed improvements in targeted executive skills (such as raising their hand to ask a question), and these social skills were generalised to the classroom. Similarly, Cheng, Huang, and Yang

(2015) found that social skills practised in a VE using HMDs resulted in the child demonstrating improved social cognition within the VE. However, the application and generalisation of these skills was not assessed within this study.

Additionally, VEs have been used to teach life skills to children with ASCs. Tzanavari, Charalambous-Darden, Herakleous and Poulis (2015) used a CAVE to simulate crossing the road. Four children with ASCs were able to acquire the skill in the VE. However, these skills were not assessed in a real-life environment during the intervention due to safety concerns. In accordance with the findings of recent reviews (Bozgeyikli, Raij, Katkoori, and Alqasemi, 2018; Parsons and Cobb, 2011), VEs appear to be a useful approach to supporting individuals with ASCs to develop social, life, and safety skills; although more up-to-date research is required.

2.5.5 Potential benefits of using VR. The systematic reviews discussed so far have indicated that VEs are an effective strategy for teaching specific skills to children with a variety of SEND. There is also evidence to indicate potential benefits to using VEs in education. A number of these benefits are outlined in Table 3. Simultaneously research has identified potential limitations of using VEs in education, and these limitations are also described in Table 3.

Table 3. *Benefits and limitations of using VEs in education*

Potential Advantages of using VR	**Limitations of using VR**
The use of VR increases engagement (Loup, Serna, Iksal and George. 2016) and more immersive environments result in more time spent on task (Reiners, Wood and Gregory, 2014).	The use of HMDs can result in cyber sickness, the prevalence of this within research varies and studies suggest that this can be influenced by a number of factors such as the quality of the display with the lower quality headsets (such as the Samsung Gear VR) increasing the likelihood of cybersickness compared to the high quality headsets (such as the Occulus Rift) (Moro, Stromberga and Stirling, 2017).
HMDs are better for teaching spatial awareness skills (Jensen and Konradsen, 2018).	Initial start up costs are expensive and there is a limited evidence base to justify this expenditure (Mannion, 2018).
The use of VR has been found to increase enjoyment (Apostolellis & Bowman, 2014).	Some headsets cannot be used by children under the age of 13 (including the Oculus Rift and Samsung Gear VR).
VR has been found to increase motivation (Dede, Clarke, Ketelhut, Nelson and Bowman, 2005).	Current VR applications are produced by the technology industry and don't readily tie in with the National Curriculum (Mannion, 2018).
Allows the creation of a safe space to practice in whilst avoiding the consequences of failure (Bozgeyikl et al., 2018).	The use of VR does not appear to be a more effective means of teaching some skills compared to traditional approaches such as work books (such as hazard perception skills) (Brooks et al., 2002).
Provides access to environments that are not readily available due to practical or safety reasons (Bozgeyikl et al., 2018).	Creating bespoke virtual environments requires specialist skills, software and time that is not readily available (Mannion, 2018).
Recent emergence of 360° degree video allows the creation of VR videos in realistic settings (Kavanagh et al, 2017).	Staff and students can be reluctant to adopt new approaches and integrate them within the curriculum (Patelidis, 2010).
It has been suggested that the use of HMDs can reduce distractions and improve concentration (Cheng et al., 2015).	There is a risk that VR can be adopted because it offers an attractive 'gimmick' rather than evidence based benefits (DfE, 2019).

2.6 A Systematic Review of the Literature on the use of 360° Video in Education

So far, this chapter has presented the evidence to demonstrate the effectiveness of VR in education. This evidence is summarised in a number of systematic reviews exploring the uses of VR (Jensen and Konradson, 2018; Freina and Ott, 2015; Kavanagh, et al., 2017). However, this chapter in conjunction with these reviews, has highlighted gaps in the existing research. One of these gaps is the lack of research with regard to the use of 360° video-based VR, which has been highlighted as a potentially effective direction for future research (Jensen and Konradsen, 2018; Kavanagh et al., 2017). Therefore, this systematic review aims to examine the use of 360° video in education. Specifically, this review aims to answer the following questions:

1. What educational settings has 360° video been used in?
2. What skills has 360° video been used to teach?
3. What procedures have been used to deliver 360° video?
4. What research methodologies have been used in 360° video research?
5. What is the efficacy of interventions using 360° video?
6. What are the current gaps in the literature?

2.5.1 Process used. This review followed the systematic review process outlined by Petticrew and Roberts (2008) as described in Table 4.

Table 4. *Steps of a systematic review by Pettecrew and Roberts (2008)*

Step	**Description of step**
1	Clearly define the review question in consultation with anticipated users
2	Determine the different types of studies required to answer the question
3	Carry out a comprehensive literature search to locate these studies
4	Screen the studies found using inclusion criteria to identify studies for in-depth review
5	Describe the included studies to map the field, and critically appraise their quality and relevance.
6	Synthesise the findings of the studies
7	Communicate the outcomes of the review

2.6.2 Inclusion criteria. To identify the relevant studies various search terms were put into multiple data bases. The search terms used in the review were: *"360° video" or "Panoramic video" or "Immersive video*" and, "*Education" or "Teach*".* Due to the diverse applications of VR research, a very broad literature review was carried out using databases from a number of disciplines. The following databases were searched: all EBSCO databases, including ERIC, British Education Index and Medline, all OVID databases, and Google Scholar. 2,812 articles were identified in this initial search. Titles and abstracts of these articles were reviewed to determine whether articles met the inclusion criteria outlined in Table 5. At this point, 14 articles were identified. Full papers were then read, and five met the inclusion criteria and were included in the review.

Table 5. *Inclusion criteria of the systematic review*

Inclusion criterion	**Description of criterion**
Setting	The study could take place within any educational setting ranging from the early years through to post graduate study.
Participants (age)	Participants could be of any age
Participants (abilities)	The study may contain participants with any level of ability including individuals with SEND needs or gifted and talented individuals.
Aims of the intervention	The intervention must have a clear educative aim such as skill acquisition. These aims should be clearly described in the study and the researcher should evaluate this aim as part of the study.
Nature of the video	The video must be recorded using a 360° degree camera.
Presentation of the video	The video must be presented in a way that allows its 360° nature to be experienced. This could be achieved through a head mounted display or an interactive screen.
Nature of the study	The focus of the study must be on the use of 360° video however a range of research designs could be used including both qualitative and quantitative designs.
Language and publication date	All studies must be written in English. Likewise, all studies must have been published within the last 10 years.
Publication style	All articles must be from peer reviewed journals.

2.6.3 Description of studies. The five studies that met the inclusion criteria are presented in appendix 1. The table in appendix 1 provides a detailed overview of the studies and includes the information described in Table 6.

Table 6. *Description of headings used to describe systematic review data*

Heading	**Description**
Study	The authors of the study and its publication year.
Setting	The setting the study was carried out in.
Skills taught	The skill that the study aimed to teach.
Participants	The number of participants and contains a brief description of them.
Display method	How the video was presented to participants for example through a HMD or computer screen.
Research Design	The type of research design employed.
Measures used	The measures used to obtain the results of the study
Findings	A description of the key findings and conclusions made in the study

2.6.4 Findings of the literature review.

What educational settings has 360° video been used in?/ What skills has 360° video been used to teach? The systematic literature review identified five studies that met the search criteria, and all of these studies took place in university settings. One of these studies had a general purpose to teach facts that were not related to a course of study (Rupp et al., 2016). Johnson (2018) aimed to teach knowledge about religious services to university students enrolled on a religious studies course. The remaining three studies aimed to teach medical skills to participants. Herault, Linckea, Forsgärdeb and Elmqvist (2018) aimed to provide trainee nurses with experience of trauma treatment in hospital. Yoganathan, Finch, Parkin and Pollard (2018) aimed to teach post graduate trainee doctors the skills

required to tie a reef knot. Meanwhile Harrington et al. (2017) aimed to provide medical students with a first-hand experience of operative procedures.

What procedures have been used to deliver 360° video? The studies reported the use of a number of devices to capture 360° video. This included expensive rigs consisting of Go Pro cameras (valued at over $5,000) (Harrington et al., 2017; Herault et al., 2018), consumer-grade devices (Yoganathan et al., 2018) and pre-recorded videos from YouTube (Rupp et al., 2016; Johnson, 2018). Likewise, 360° video has been displayed through a number of devices, including interactive screens (Herault, Linckea, and Forsgärdeb, 2018) computer-based HMDs (Yoganathan et al., 2018), and mobile based HMDs (Rupp et al., 2016). Herault et al. (2018) presented the video to multiple participants simultaneously using a laptop, while all of the other studies in the review used individual screens to present the video. Herault et al. (2018) reported some limitations with presenting the device through a shared screen, especially regarding navigation, since adjusting the FOV would be taken on by one member of the group. Furthermore, 65% of participants reported difficulty in using the laptop to navigate the 360° video. Elsewhere, Rupp et al. (2016) compared different presentation devices including a mobile phone screen, Google Cardboard (a mobile-based VR system) and the Oculus Rift (a computer-based VR system). This study found that overall, there was no significant difference in fact recall between the devices. However, it was found that higher levels of immersion moderately increased presence (i.e. the Oculus Rift was the most immersive approach, whilst the phone screen was the least immersive). Increased presence was associated with lower recall of auditory input and it was hypothesised that this could be because participants were too immersed in the visual environment to attend to the auditory narration.

What research methods have been used in 360° video research?. Three of the five studies included in the review used experimental research methods to investigate the effects of 360° video. Rupp et al. (2016) used experimental methods to compare the effect of different ways of presenting 360° content with different devices forming different conditions. Both Yoganathan et al. (2018) and Harrington et al., (2017) used experimental design to compare the use of 360° video to 2D video, with each of these formats forming an experimental condition. However, only one study controlled the potentially confounding variable of participants' pre-intervention knowledge by carrying out a pre-intervention assessment (Rupp et al., 2016). Experimental research approaches have also considered a number of other variables that may influence participant engagement with 360° video, including levels of presence, attitudes towards VR, levels of sickness (Rupp et al., 2016), and non-task-related thoughts (Harrington et al., 2017). Elsewhere, Johnson (2018) used a mixed methods approach that included qualitative and quantitative student surveys and his own reflections to evaluate the use of 360° video to teach religious education. Meanwhile, Herault et al. (2018) used qualitive methods, including observations of group sessions and student questionnaires, to evaluate the use of 360° videos in collaborative discussion-based learning.

In summary, both qualitative and quantitative methods have been used to evaluate the use of 360° video. Studies using mixed and qualitative design (Johnson, 2018; Herault et al., 2018) failed to provide a valid comparison group and relied on participants' experiences of other teaching styles to inform the evaluation. Participants in these studies responded positively to the use of the 360° videos; Johnson's (2018) participants rated the use of 360° video as a 7.9 out of 10 and 94% of Herault et al.'s (2018) participants appreciated the use of 360° video. However, it is unclear whether

this positive response would be maintained over time given that the introduction of 360° equipment is novel. Likewise, these studies failed to show that the use of 360° video resulted in improved learning outcomes. On the other hand, experimental designs demonstrated a clear comparison between 360° video and traditional viewing methods as they also measured an impact on learning outcomes. Yet, they also included anecdotal comments from participants with their discussions suggesting that the objective measures used in this research are unable to provide a full overview of the application of 360° video in education. Therefore, it appears that both the comparative and evaluative research designs discussed in this review offer unique benefits to 360° video research.

What is the efficacy of interventions using 360° video? Rupp et al. (2016) presented participants with 360° videos of the international space station. Video presentation format varied depending upon conditions and included either a phone screen, Google Carboard, or an Oculus Rift. There was no significant difference in fact recall overall, but there was a moderate effect between levels of presence and the device, with more immersive devices increasing presence. However, heightened presence was found to reduce recall of auditory information which suggests a negative link between presence and auditory memory. Meanwhile, Harrington et al. (2017) also measured fact recall from videos of operative procedures. This study found no significant difference in recall between the 360° and 2D video conditions. However, measures did indicate that levels of engagement and reduction of non-task-related thoughts were significantly improved within the 360° video condition.

Elsewhere, Yoganathan et al. (2018) reported that 360° video significantly increased performance when used to teach trainee doctors how to tie reef knots. In this study participants were required to observe a video of a reef knot being tied before

being asked to complete the task independently. Accuracy of the skill (as measured by an observation schedule) was significantly better in the 360° video condition compared to the 2D video condition, although there was no significant increase in speed. These findings suggest that 360° video could be an effective means of teaching motor skills. These findings reflect those of Jensen and Konradson (2018), who concluded that VR is an effective means of teaching psycho-motor skills, visio-spatial skills and cognitive skills, but not other skills, including the acquisition of facts.

The findings of experimental studies provide mixed results. Yoganathan et al. (2018) found that 360° video significantly improved skill acquisition compared to 2D video, while Harrington et al. (2017) did not find a significant difference between conditions. The nature of the skills taught in these studies were different and it is possible that 360° video is more effective at teaching the practical skills in Yoganathan et al.'s study (2018). Both Rupp et al. (2016) and Harrington et al. (2017) concluded that immersive 360° video increases levels of presence, task engagement, and on-task behaviour. While these increases did not translate to significant improvements in performance, these benefits have also been observed in the research of other VR formats (Freina and Ott, 2015), and this research suggests that these benefits are also apparent in 360° video presented through HMDs.

Studies that measured attitudes towards 360° video all reported that the majority of participants had positive attitudes towards the use of VR (Rupp et al., 2016; Herault et al., 2018; Johnson, 2018). Furthermore, Johnson (2018) found that the use of 360° video allowed some members of his religious studies class to experience religion in a way that increased empathy towards other religions. VR has been described as "the ultimate empathy machine" (Milk, 2015) due to its ability to transport users into the lives of others, and Johnson's findings indicate that this also applies to

360° video. Additionally, Rupp et al. found that individuals with positive attitudes towards VR performed significantly better than those with a negative attitude. Whilst the implications of this finding are unclear, it may be that some individuals are more motivated to learn through VR which, in turn, improves performance.

Not all participants reported positive experiences with the 360° video. Three studies found that participants experienced nausea whilst using HMDs (Rupp et al., 2016; Johnson, 2018; Harrington et al., 2018). While these individuals were in the minority, it is important to note that HMDs can induce cybersickness. Of the two studies that did not report any adverse side effects, one used short videos compared to other studies, which is likely to reduce the likelihood of developing cybersickness (Yoganathan et al., 2018). The other study used a laptop display, which does not induce cybersickness (Herault et al., 2018).

What are the current gaps in the literature? Due to the recent development of 360° video, there are a limited number of studies in this area with all of the research being from the last 3 years. Consequently, there is a need for a wide array of future research. The majority of existing research focuses on teaching fact-based knowledge acquisition, and only one study looked at the acquisition of practical skills. Therefore, more research needs to be carried out that explores a variety of 360° video application to determine whether it is more effective at teaching specific types of skill. Furthermore, studies in this review failed to evaluate the maintenance of skills over time or the generalisation of skills. Additionally, all of the research in this review was carried out with adults in universities. Consequently, 360° video should be evaluated with a range of individuals of different ages and with different levels of cognitive ability, especially considering the fact that other VR based approaches have been successfully applied to support children with SEND.

2.7 The Present Study- Immersive Video Modelling (IVM)

Based upon the synthesis of literature of VM and VEs, it is apparent that there are several overlapping concepts within the approaches. VM relies on the presentation of skills via video, whilst VE instruction involves the presentation of skills through a virtual environment. Technological developments now permit the creation of VE through the use of 360° video, thus making the creation of these virtual environments almost as easy as recording video. Furthermore, PVM research indicates that the presentation of a first-person video is an effective means of instruction (Mason, 2013). Therefore, combining these approaches appears to be a logical progression that is facilitated by recent technological developments. The literature review failed to identify any published research that evaluated the use of 360° video to teach skills to children, indicating that this is an unchartered area for research. It is therefore important to clearly define what IVM is and provide a theory-based rationale for its use.

I propose that IVM is an approach to teaching skills that involves presenting an individual with a VE that is created through 360° video technology. Participants are presented with the video through an HMD that allows them to explore the salient points of video from a first-person perspective. The videos also include audio information that enriches participants' understanding. Depending upon the nature of the task, this could include narration (for instances where there is no natural discourse) or natural discourse (for skills involving social interactions). The video is presented to the participant on several occasions in anticipation that they will acquire the skill.

This literature review has demonstrated that the use of visual approaches such as VM and VEs, have been shown to have good evidence bases for application with children with SEND (Bozgeyikli, Raij, Katkoori, and Alqasemi, 2018; Standen and Brown, 2005; Jeffs, 2010). Likewise, 360° video has been shown to be effective at

teaching skills to adults (Harrington et al., 2017; Yoganathan et al., 2018). This evidence provides a foundation for IVM, which shares its theoretical foundations with VM and skill instruction through VEs. The relationship between VEs, PVM, and IVM is described below in Figure 2.

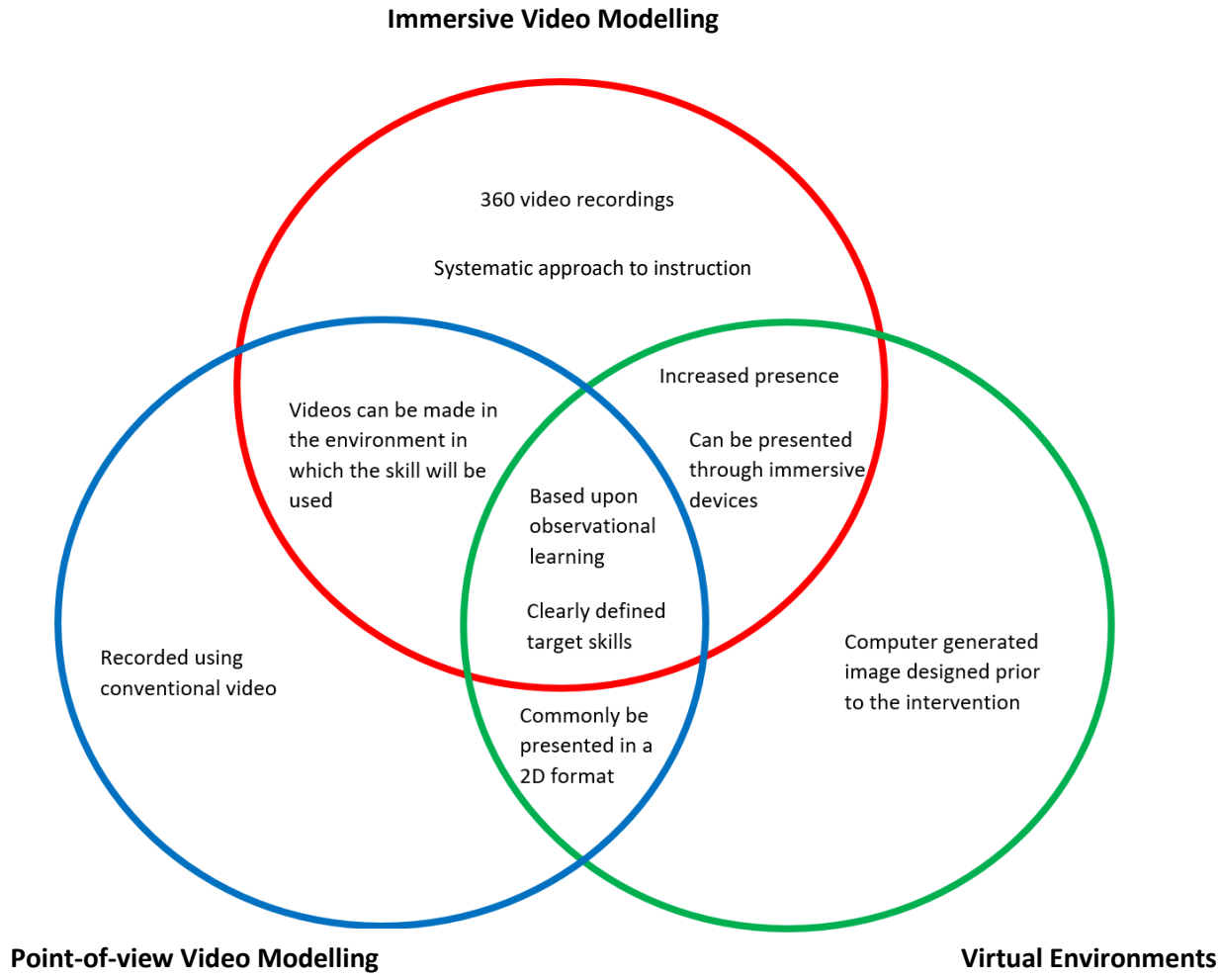


Figure 2. The similarities and difference between Immersive Video Modelling, Point-of-view Video Modelling and use of Virtual Environments.

Instructional psychology provides further theoretical foundation for IVM's efficacy. Mayer's Cognitive Theory of Multimedia Learning (CTML) proposes that certain practices allow instruction using media devices to be presented in a way that

results in greater levels of learning (Mayer, 2005). In summary, CTML proposes that learning primarily takes place through two channels, visual and auditory, and inputs from these channels interact with working memory. Individuals are required to organise and integrate these inputs in a meaningful way to engage in active learning (rather than rote learning, which does not involve organisation). However, these channels have a limited capacity for receiving information and instruction should be optimised to ensure that only information salient to the learning task should be perceived by the learner to enhance the efficiency of learning (Mayer, 2009). To accommodate this, Mayer (2009) outlines 12 evidence-based principles that are present in effective education. These principles are considered below (Table 7) to identify how they can be integrated with IVM, and this indicates how IVM can align with CTML. The application of these principles further enhanced the evidence base supporting IVM as a potentially viable intervention that aligns with evidence-based approaches.

Table 7. *The application of CTML to IVM based upon Mayer's (2009) 12 principals*

Principal	Description of principal	How this can be applied in IVM
Coherence Principle	People learn better when superfluous information is removed	Videos can be created in a controlled environment that removes unnecessary information. HMDs also ensure that information from the real world is shut out
Signaling Principle	People learn better when essential information is highlighted	Narration can be used to direct participants attention to key aspects of the video
Redundancy Principle	People learn best from a combination of visuals and narration	Narration can be included within the video
Spatial Contiguity Principle	People learn better when visual information and text is presented in close proximity to each other	Text can be added to the video through post production editing so that text appears as a subtitle during the video
Segmenting Principle	People learn better when information is presented at the user's pace	Skills in videos can be performed at the users preferred pace. Videos can also be paused and rewound by participants
Pre-training principle	People learn best when they have pre training in the names of key components	Pre-teaching can be provided so that participants are familiar with the concepts and language and objects within the video
Modality Principle	People learn better from graphics and narration rather than graphics and printed text	Narration can be completed while the video is recorded or it can be added after the video has been produced though the use of editing software
Multimedia Principle	People learn better from words and pictures rather than words alone	IVM is primarily a visual approach and always includes a video.
Personalization Principle	People learn better when words are presented in a conversational style	Language used can be adjusted to be appropriate for the participant. This can be informal and will be pitched at a developmentally appropriate level
Voice Principle	People learn better when words are spoken by a human voice rather than machine voice	Narration or conversation within the video will be performed by a human
Image principle	People do not necessarily learn better when the speaker's image is on the screen	The speaker's image is only on the screen if the discussion is part of the skill being performed. Participants may be able to see the face of the person performing the skill if they look towards the back of the video, however, if this happened participants should be prompted to re-focus on the skill.

2.8 Research aims

The research aims were derived in accordance with the guidelines for developing research questions in mixed methods research (Creswell and Plano Clark, 2007). Separate research questions were produced to reflect both the quantitative and qualitative phases of the study.

The quantitative phase of the study has the following quantitative hypothesis:

1) Immersive video modelling will allow participants to master target skills.
2) Immersive video modelling will lead to the increased generalisation of skills.
3) Immersive video modelling will result in skills being maintained following the intervention.

The qualitative phase of the study has the following research questions:

1) What are the experiences of individuals implementing an IVM intervention in regard to the delivery of the intervention and the observed results?
2) What are the participants' attitudes towards IVM after delivering an IVM intervention? What are the perceived benefits and disadvantages of IVM?

Both quantitative and qualitative phases of this research aim to address the overall purpose of this study. This study aims to establish the efficacy of IVM when used to teach shoelace tying in a special school context. Meanwhile, it also aims to explore how easily this technology can be applied in this setting and identify any potential barriers that may be present in its application.

Chapter 3 - Methodology

3.1 Introduction

This chapter begins by outlining pragmatism, the research paradigm used in this study. Mixed methods research is then described as the research design used. Specifically, a sequential exploratory mixed methods design is described; this consists of a qualitative and quantitative phase, and this methodology chapter is structured in accordance with these phases. The quantitative phase uses an AB experimental design and systematic instruction is used to inform the delivery of the intervention. The qualitative phase uses semi-structured interviews to gain an understanding of the experiences of staff delivering the intervention and address the research questions. This chapter ends by outlining the ethical issues that were identified and managed within this research.

3.2 Research paradigm

Pragmatism was used as the research paradigm to underpin this study. Pragmatism is defined as:

"a deconstructive paradigm that debunks concepts of 'truth' and 'reality' and focuses on 'what works' as the truth of the research question under investigation." (Tashakkori and Teddlie, 2003, p.713).

Described as "the third methodological movement" (with quantitative and qualitative being the first two movements) (Teddlie and Tashakkori, 2009, p. 77), it aims to establish a middle ground between philosophical dogma and partisan approaches to research. It rejects the binary approaches that are implicit within philosophy (such as subjectivism versus objectivism) and endorses pluralism and carefully considered eclecticism (Johnson and Onwuegbuzie, 2004).

Morgan's (2014) conceptualisation of pragmatism integrates traditional notions of pragmatism with Dewey's concept of experience and enquiry. Morgan argues that pragmatism delineates itself from traditional philosophical underpinnings, avoiding the metaphysical concepts of ontology, epistemology, and methodology. Instead, he draws upon Dewey's work to emphasise the importance of the contextual, social, and emotional influences that are central to the human experience. This frames the human experience as a cyclical interaction between 'reflecting on beliefs to choose actions' and 'reflecting on actions to choose beliefs' (Dewey, 2008). This interaction informs the nature of inquiry, which results in a continual cycle between actions and beliefs, thus making inquiry (or knowledge) an ever-changing process that takes place within an individual (Morgan, 2014). This contrasts with other paradigms that offer static interpretations of the 'truth' through metaphysical explanations. Therefore, the pragmatic paradigm offers an approach to research that is considerate of the human experience and allows the researcher's beliefs to inform their actions. Consequently, this paradigm is best suited to mixed methods research, since mixed methods approaches require me to be flexible and choose 'what works' based upon my current knowledge and the research question (Teddlie and Tashakkori, 2009).

3.3 Research Design

A mixed methods research design was used in this study. Mixed methods research is defined as:

> "A type of research design in which qual[itative] and quan[titative] approaches are used in types of research questions, research methods, data collection and analysis procedures." (Tashakkori and Teddlie, 2003, p.711).

Aligned with pragmatism, it focuses on “what works” in answering the research question being investigated (Tashakkori and Teddlie, 2003, p.713). In doing this, it has been suggested to emphasise the “complementary strengths” of different research methods whilst accounting for “non-overlapping weaknesses” of differing approaches (Johnson and Turner, 2003, p.299). This overcomes some of the limitations of single method designs. For example Cresswell, Plano Clarke, Gutmann and Hanson (2003) note that quantitative data alone does not always provide sufficient explanation as to the experiences of the individuals involved in the study. However, through the use of mixed methods, confirmatory and exploratory research questions can be addressed simultaneously, which allows a researcher to “verify and generate theory in the same study” (Teddlie and Tashakkori, 2009, p.33). This means that, in this study, quantitative data can be used to verify the efficacy of the intervention, whilst qualitative data can be used to form an understanding as to why those results were obtained. Thus, the qualitative data is able to provide further insight into the quantitative findings (Ivankova, Cresswell, and Stick, 2006). This is especially beneficial in this research as IVM is a new approach and there is no published research regarding the use of 360° video with children with SEND. Consequently, further elaboration of quantitative findings would allow more accurate interpretation of the results of this study as there is little other research to draw upon to aid data interpretation.

The decision-making matrix for determining a mixed methods research design (Cresswell et al, 2003) was used to elaborate on the type of mixed methods design used. This framework encourages the researcher to consider the aspects described in Table 8. My considerations in relation to these aspects are also included within this table.

Table 8. *The application of the decision making matrix for determining mixed methods research design based upon Cresswell et al. (2003)*

Aspect of consideration	Definition of aspect	Consideration within this study
Implementation	The order in which the different aspects of the research design are completed (for example: concurrent, sequential qualitative first or sequential quantitative first).	A sequential approach in which the quantitative phase was completed first was used. This was necessary as the qualitative aspect of this study aimed to elaborate on the results of the quantitative phase.
Priority	The weight given to a specific phase of the study. Some studies may have greater weight placed on qualitative phases while other studies may give both sets of data equal influence.	Increased priority was given to the quantitative phase of this study because the main focus of this research was to determine the efficacy of the intervention. The purpose of the qualitative data was to enrich the quantitative data which resulted in less emphasis being placed on these findings.
Integration	The point at which qualitative and quantitative data are combined. This can happen during data collection, during analysis or during interpretation. This can also happen at multiple points.	Data was integrated at two points. Firstly, data was integrated at the data collection phase as the findings of the quantitative phase influenced the questions asked during the semi-structured interviews. Data were then analysed separately but were combined again during the interpretation phase of the study.
Theoretical perspective	This refers to the researcher's elaboration of their theoretical perspectives and is normally most common in work that aims to be socially or politically transformative. The views of the researcher should be clearly described.	This research used pragmatism as its theoretical perspective.

Given the considerations made within the decision-making matrix, it was decided to use a sequential exploratory design in this research (Cresswell et al., 2003). This design involves two sequential phases: quantitative data collection,

followed by qualitative data collection. The findings of the quantitative phase were used to inform the content of the semi-structured interviews. The two sets of data were then brought together during data interpretation. To provide clarity and transparency within the application of this model, Ivankova et al. (2006) advise that the approach is represented visually; this can be seen below in Figure 3. This model was selected as it provides a clear and transparent medium to carry out mixed methods research. It also allows a deeper analysis of quantitative data, which has been noted to be especially useful when unexpected findings are produced (Morse, 1991). To provide further elaboration on the methods used, the designs of the quantitative and qualitative phases within this study are described in Sections 3.3.1 and 3.3.2.

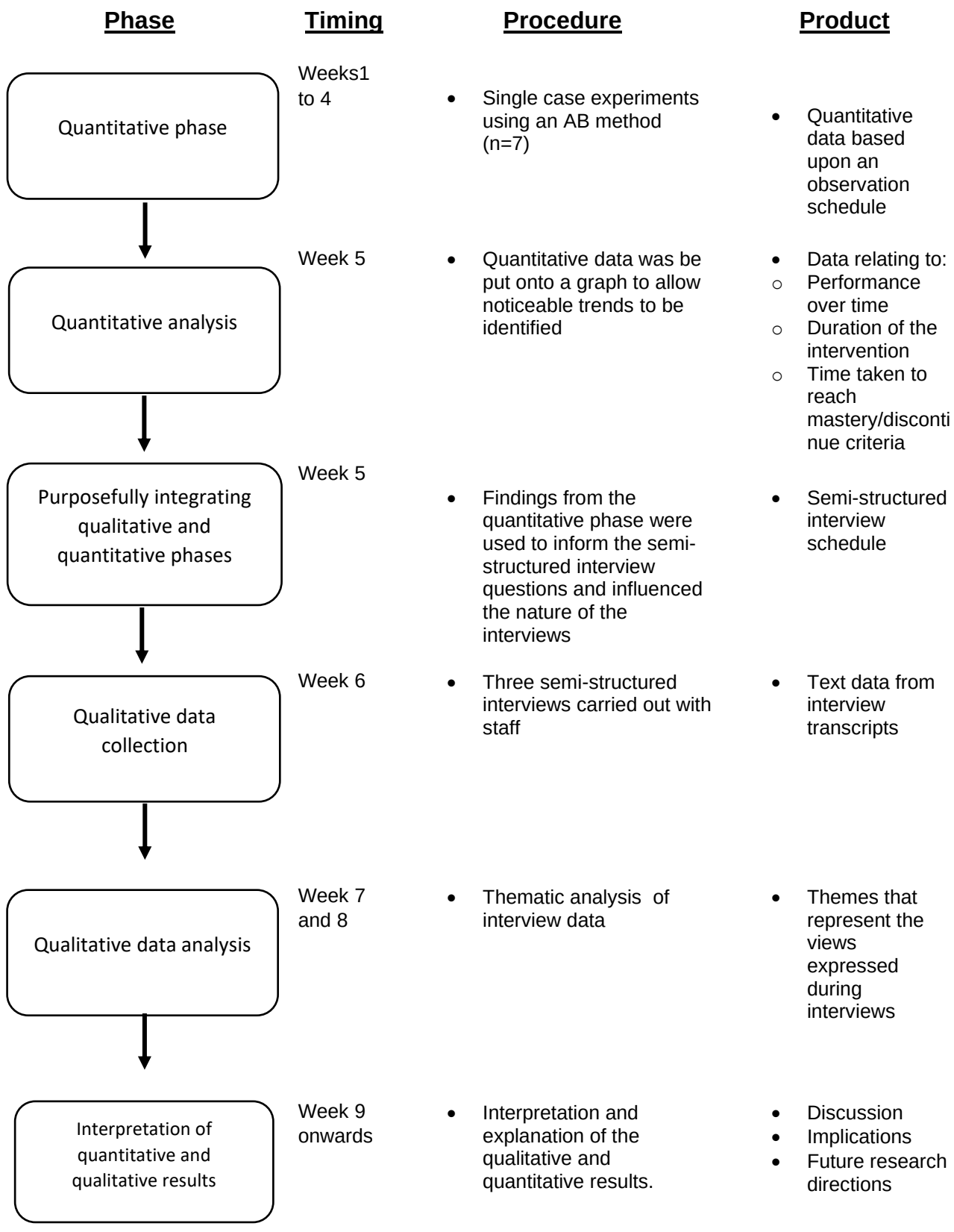


Figure 3. A overview of the sequential exploratory mixed methods research design used in this study.

3.3.1 Quantitative phase. The purpose of this phase was to identify the efficacy of the IVM intervention and address the three hypotheses:

1) Immersive video modelling will significantly improve independence skills from baseline levels.

2) Immersive video modelling will lead to increased generalisation of skills.

3) Immersive video modelling will result in skills being maintained following the intervention.

To do this, a single-case experimental design (SCED) was used. An experimental design was implemented, as it was vital that the performance of the individuals completing the intervention was compared with a valid comparison measure. It was hoped that this could be achieved through a control group. However, this was not possible due to the small number of participants. Therefore, a SCED was selected as it allows the participant to act as their own baseline measure, thus providing a comparative measure on which the efficacy of the intervention can be assessed.

SCED is rooted in the behaviourist school of psychology and was pioneered by radical behaviourists such as Skinner (1974). They are cited to evoke strong feelings within the research community, in which the approach is uncritically adopted by some and dismissed outright by others (Robson and McCartan, 2016). Some argue that the SCEDs are inferior to other experimental designs as they fail to eliminate all major threats to internal validity to be able to infer valid conclusions from the results (Shadish, Cook, and Campbell, 2002). However, others suggest that SCEDs offer a “rigorous, methodologically sound alternative to evaluation” (Smith, 2012, p. 1) that are especially suited to evaluating interventions (Horner et al. 2005). Due to the pragmatic foundations of this research, the partisan arguments of

advocates or proponents of the approach are less influential in the selection of the method than may be apparent when adopting other paradigms.

Horner et al. (2005) outlines a number of characteristics that are central to the use of SCEDs to evaluate interventions with children in special education, and these characteristics are summarised in appendix 2 and provide the foundation for the use of the SCEDs in this research. These characteristics are central to all SCED research within special education and therefore provide the foundation for the quantitative methods used within this study.

While there are central tenants to all SCEDs, there are also variations within the approach that allows SCEDs to be adapted to a number of situations. One medium of carrying out a SCED is through the use of a reversal design such as an ABA design. These designs involve the baseline phase (A), followed by an intervention phase in which an independent variable is introduced (B), and then a subsequent withdrawal of the independent variable and a return to the baseline measure (A). Through the use of this design, it is expected that the withdrawal of the independent variable will result in a regression of the dependent variable towards the baseline, thus demonstrating a relationship between the two (Smith, 2012). Meanwhile, Kazdin (2010) notes that reversal designs can also be used to demonstrate maintenance of the dependent variable following intervention.

However, there was a practical barrier to using an ABA design since the intervention took place before a school holiday, which prevented a second baseline being taken immediately after the intervention phase. It was not possible to postpone the intervention, which meant that an ABA design was not feasible. For this reason, an AB method was used in which generalisation and maintenance were assessed following the school holiday. This method is less robust than other SCEDs and is

regarded as a quasi-experimental approach as it does not control threats to internal validity (Byiers, Reichle, and Symons, 2012). However, from a pragmatic perspective, the use of a second baseline, may in fact, threaten the validity of a maintenance measure, since the maintenance of a skill is defined as being able to perform the skill with a break in instruction or practice (Haring and Eaton, 1978). Therefore, the omission of a second baseline phase may make the maintenance measure more reliable as this permits a break from formally practising the skill. Through considering the views of stakeholders, time and staffing constraints, the research method had to be adjusted to an approach that was less desirable from a research perspective. These compromises reflect carrying out research in *the real world* as described by Robson and McCartan (2016).

Within the experiment there was one independent variable (IV); the exposure to the IVM intervention. There were also four dependent variables (DV):

1) The participant's progress in the experimental conditions (as measured using an observation checklist described in the procedure in appendix 3.
2) The number of sessions taken to achieve the mastery criterion (80% success rate for three consecutive sessions).
3) The participants' ability to generalise skills to different settings and different people (this measure was taken after the participant had reached the mastery criterion).
4) The participant's ability to maintain the skill two weeks after achieving the mastery criterion.

Baseline measures were carried out before participants were exposed to the IV to "gather a representative, stable sampling of behaviour before manipulating the IV"

(Smith, 2012, p. 11). To obtain a stable baseline of the participants' ability to perform the task, participants were asked to perform the skill without instruction and their progress was recorded using an observation schedule that broke the skill down into smaller steps. Three baseline measures were administered, as this had been reported to be the minimum number of baseline measures in SECDs (Kratochwill et al., 2010). I decided to use the minimum number of baselines in this study, as school staff suggested that asking a participant to complete a skill that they know they cannot do could be demoralising. Three maintenance measures were also carried out following the study to gain a stable measure of whether the skill has been maintained following the intervention. Additionally, an assessment of the generalisation condition was carried out during the baseline phase to ensure that the participant's skills within the generalisation assessment were comparable to those of the taught condition. The nature of baseline, intervention, maintenance and generalisation phases are described in table 9.

Table 9. *A description of the phases of the experiment*

Phase of experiment	Conditions	When this took place
Baseline	Participants are asked to tie the shoe lace with no instruction. Correct responses are rewarded with non-directive positive feedback.	At the start of the study before the intervention phase
Intervention	Participants watch an immersive video of the target skill being carried out before being asked to carry out the target skill themselves. This phase continue until the participant reaches the mastery criteria on three consecutive sessions.	Following the baseline phase
Maintenance	The participant is asked to complete the target skill with no instruction or feedback from an adult.	Two weeks after the participant reaches the mastery criteria.
Generalization	The participant is asked to tie their own shoe whilst wearing it. This takes place in the same location in which the other phases took place.	Generalization probes are completed alongside baseline probes to ensure that the participant is not able to complete the generalization skill prior to the assessment. They are also completed alongside maintenance probes to determine if learning has been generalized.

To ensure that the intervention was set up in a valid and reliable way, systematic instruction (Snell, 1990) (which aligns itself with the use of SCEDs) was used to structure the intervention. This process is described in Section 3.5.2.

3.3.2 Qualitative phase. To provide a research frame for the qualitative phase of the study, a case study approach was used. A case study is defined as:

"an in-depth exploration from multiple perspectives of the complexity and the uniqueness of a particular project… in a real-life context… The primary purpose

is to generate an in-depth understanding of a particular topic" (Simons 2009, p.21).

A case study method was selected due to the "in-depth" nature of the approach. It allows the case to be considered from multiple perspectives, which reflects the varied roles of the participants. It also complements mixed methods approaches and is commonly used within the qualitative phase of mixed methods research (Teddlie and Tashakkori, 2009). Furthermore, the design frames' ability to generate theory offers a further benefit, as a key function of this phase is to generate theory regarding the use of IVM. Theory generation is the concept that you "…do not start with a theory but aim to end up with one, gained systematically through the data" (Robson, 2011, p. 66). Given the lack of prior research in this area, theory generation regarding the outcome of this research project will provide some insight into how IVM functions, as well as offering an explanation of the quantitative findings.

Thomas (2016) outlines the importance of distinguishing between the components of the case. He argues that a case consists of a "subject" (i.e. the person or place the case study focuses on) and the "object" (the analytical frame or theoretical basis of the case). Within this case study, the subject is the staff involved in delivering IVM within a special school while the object is IVM. Thomas (2016) provides further guidance as to how to structure a case study, arguing that the subject, purpose, approach, and process need to be considered to illustrate the type of case study being applied. These aspects are considered in Table 9 to provide further elaboration as to the nature of the case study used within the qualitative phase of this project.

Table 10.*The structure of the case study used in this research based upon Thomas (2016)*

Thomas' overarching categories		Definition	Kind of case study selected	Rationale
Subject		The researcher's reason for choosing their area of focus	Local knowledge case	The case is known to me though my own research and It offers an example of IVM.
Purpose		The reason for carrying out the case study	Explanatory	The case study aims to provide a more in depth understanding of the quantitative results of the research
Approach		How the case study is carried out	Building a Theory	IVM is a new intervention and there are currently no ideas (or theory) regarding how to successfully run an IVM session. Consequently, the case study intends to begin to generate some of these ideas.
Process		The style and the manner of how the case study is structured	Single-Snapshot	The focus of the case is the intervention, not the individual participants. Therefore, the case (i.e. the intervention) is a single entity rather than multiple cases of the child participants doing the same intervention. All interviews were conducted on the same day shortly after the intervention had ended which resulted in the process being a single 'snapshot' of their views at that time.

3.4 Participants

3.4.1 Sampling. Purposive sampling was used to recruit participants for this study. Purposive involves selecting cases "based on a specific purpose rather than

randomly" (Tashakkori and Teddlie, 2003, p.713). This method of sampling was selected since child participants needed to be aged over 13 in order to be able to use the VR headset in accordance with the manufacturer's manual. They also needed to be working towards developing independence skills. Given these requirements, I felt that I was most likely to find participants who met these criteria in a special school rather than a mainstream setting. Given the specific nature of participants required for the study, I approached the head teacher of a local special school to identify potential participants who met the above criteria; he identified a year 9 class who met the inclusion criteria.

3.4.2 Recruitment. Adult participants agreed to participate during a meeting in which I explained the nature of the study and the requirements of their participation. An information sheet was shared with them to provide them with more information about the study (refer to appendix 4). Children and their parents were then invited to an information session (refer to appendices 5 and 6) during which the nature of the study was explained, and the VR headset was demonstrated (refer to appendix 7). Following this session, parents were asked to give consent for their child to take part (refer to appendix 8). Child participants were also asked to provide verbal consent to take part in the study, I completed a script to record that participants had been made aware of key aspects of the study (refer to appendix 9). Adult participants also read a script that explained key aspects of the research (appendix 10) before being asked to provide consent to take part in the study (appendix 11)

3.4.3 Child participants. Five child participants (referred to as children for the remainder of this thesis) agreed to take part in the study. They were all part of the same year 9 class in a generic special high school based in the Midlands. Participants were recruited through the researcher's role in the local authority as a trainee

educational psychologist. Participants were aged between 13 and 14, and were placed in the chronologically appropriate year group. All participants have education, health and care plans due to their significant levels of additional needs. However, the group's additional needs are diverse. To provide greater insight into the needs of the participants, pen portraits of individuals are included in the results chapter. All child participants were assessed using the daily living skills sub-domain of the Vineland Adaptive Behaviour Scales 3 (VABS3) (Sparrow, Chicchetti, and Saulnier, 2016) to provide an understanding of the functional skill development of the individuals in the study. The VABS3 was used as it may identify skills that the child could learn during the intervention as well as providing a standardised measure of children's daily living skills.

It was essential that children were unable to complete their selected functional skill. This was measured in the baseline section of the experimental phase. Participants were also required to have the motor and cognitive skills to complete these activities. The class teacher's experiences of working with children who have learning difficulties was used to determine the appropriateness of the selected skill as there are no formal measures that could have been used to make this judgment. The safety precautions outlined in the risk assessment also contributed to the inclusion criteria (see Section 3.7).

3.4.4 Adult participants. Three adult participants (referred to as adults for the remainder of this thesis) were included in the study. They all worked in the class where study took place on a full-time basis. Participants' roles included the Class Teacher, a Teaching Assistant and an Apprentice Teaching Assistant. Adults were required to have observed at least one IVM session to be eligible to take part in the study. Two of

the adults experienced delivering the intervention whilst the third adult participant observed the sessions.

3.5 Procedure: Quantitative Phase

3.5.1 Introducing the project. The United Nations Convention of the Rights of the Child (UNCRC) highlights that children must be able to express their views in relation to decisions that involve them (United Nations, 1989). Hart (1992) provides a conceptual model to identify different forms of child participation within research projects. This hierarchical model of participation draws a distinction between participation and non-participation and creates a structure that allows researchers to work towards the highest possible levels of participation. As this research is adult directed, it was not possible to achieve the highest levels of participation. However, participants were given the opportunity to make shared decisions regarding the nature of the study, thereby ensuring higher levels of participation.

To provide the child participants with the opportunity to make decisions within the project, I met with children and parents of the year 9 class to introduce the research project and gain parental consent. Invitations were sent to parents and children (see appendices 5 and 6) and this meeting took place one evening after school. Four participants and their parents were able to attend the meeting. During this meeting, adults and children were given a presentation that outlined the nature of the study, alongside other key information (see appendix 7). Attendees were given the opportunity to wear the headset and watch a 360° video using a traditional display and they were invited to consider what life skills they would like to learn during the intervention. Some skills were suggested during the meeting (see appendix 7), however, the decision as to which skill children learned was left for parents, children and staff to discuss together. Adults and staff were given two weeks following the

meeting to support children in making a decision regarding which skill they learned. However, the final decision was made by children and their choice of preferred skill was established prior to the intervention. In total three different skills were selected by participants. These included tying shoelaces, making a cup of tea, and making a sandwich and some squash. However, during the initial baseline sessions, it became apparent that two of the children had already mastered their selected skills (making a cup of tea and making a sandwich and squash). Following further discussion with the children they asked to learn to tie shoelaces.

It must be noted that the involvement of adults in the decision making process reduced the levels of child involvement in this study. However, it was apparent through my initial conversation with children that they found it challenging to consider what skills they wanted to learn and adult support was required to allow them to consider this. This was demonstrated by the two children who selected skills that they could already perform. Children communicated that they could perform this skill at the start of the baseline sessions which suggested that they had found it challenging to think about things that they could not already do. Interestingly, all children showed high levels of enthusiasm around learning to tie their shoelaces. This idea was initially suggested by a parent and children became very motivated by this idea, even those who did not suggest this skill. Therefore, the inclusion of adults in the decision making process appeared to enhance the children's ability to engage in the decision making process.

3.5.2 Structuring the intervention. While the majority of video modelling research uses a shared structure, it often focuses on the intervention (i.e. the use of the video model) and fails to provide any form of insight into why the skills were selected and how the curriculum around the intervention was developed. To address

this shortcoming, this study developed a curriculum using systematic instruction. Systematic instruction is a systematic method of teaching new material that emphasizes mastery through the careful design and delivery of instruction (Powell et al., 2012).

Within the field of educational psychology, this approach is most well known for being used to teach reading as it provides the foundation of direct instruction (Carnine, Silbert, Kame'enui and Tarver, 2009). However, the approach has a wide range of applications, including teaching functional skills (Morse and Schuster, 2000) and increasing on-task behaviours in schools (Callahan and Rademacher, 1999). Snell (1990) offers an in-depth description of this approach and how it can be applied to teach functional skills, including self-care skills, dressing, communication skills, and social skills. Snell's work underlines the benefit of systematic instruction and provides a structure for its use within this research.

Snell and Grigg (1990) outline an integrated five stage programme for carrying out systematic instruction. These phases are as follows:

1) Assessment
2) Curriculum development
3) Analysis of behaviour
4) Programme development
5) Programme evaluation

These steps were followed to develop an appropriate curriculum to deliver the IVM intervention.

3.5.2.1 Phase 1: Assessment. Snell and Grigg (1990) outline three ways of carrying out an initial assessment within this phase, which includes norm-referenced

tests, multi-disciplinary assessment, and ecological inventory. Norm-referenced tests provide the benefit of offering a broad overview of a child's development and provide direction for more precise assessment. In this study, VABS3 (Sparrow, Chicchetti, and Saulnier, 2016) was used to provide an overview of the participants' development of daily living skills, serving as a basis for a more in-depth assessment. Next, both parents and children were asked to identify a skill that was important to the child. This allowed the selection of a skill that was meaningful and useful to that participant which Hawkins and Hawkins (1981) emphasised as being central to systematic instruction. A number of skills were selected initially (see Section 3.5.1). However following baseline sessions, it was agreed that all participants would learn to tie a shoe-lace.

3.5.2.2 Phase 2: Developing a functional curriculum. During this phase the researcher should synthesise all of the information obtained during the assessment phase to develop an appropriate curriculum. As a full curriculum was not being developed (consisting more of multiple skills), this study focused on the single skill identified during the assessment phase (shoelace tying). Snell and Grigg (1990) outlined that it is essential that this skill is chronologically and developmentally appropriate for the participant to be able to perform it. School staff advised that they felt the children had the motor skills required to perform the skill and that they had the cognitive skills to copy the videos. Snell and Grigg (1990) also highlighted that It is also important that the people delivering the intervention have the materials to be able to teach this skill. I provided the staff with all of the required equipment and provided them with training and ongoing support during the intervention to fulfil this criterion.

3.5.2.3 Phase 3: Analysis of behaviour. A task analysis of behaviour was carried out to allow the behaviour to be taught and assessed in a consistent and valid way. While there are many multi-stepped approaches to task analysis (e.g. Alberto

and Troutman, 2012; Becker, Engelmann and Thomas, 1975) Snell and Grigg (1990) proposed a simplified three-step approach to task analysis that incorporates the key procedures of other approaches. This approach is summarised in Table 10.

Table 11. *The application of Snell's (1990) three step approach to task analysis*

Step	Stage of the task analysis	Skill identified in this task analysis
1	Identify the functional skill that is considered to be an important instructional target for the student.	All participants chose to learn how to tie a shoe lace.
2	Define the target skill including a description of the setting and materials most suited to the natural performance of the skill.	The skill was performed using the method outlined by Martin et al. (1971) using thick shoe laces of different colors to support skill acquisition and reduce the fine motor and cognitive demands required to perform the skill (Rayner, 2011).
3	Perform the task as it is completed in the selected setting using the chosen materials and observe skilled individuals perform the task. Then develop and validate the task analysis.	I completed the task analysis independently using a recording of me completing the video. A separate task analysis was carried out by a college and these analyses were synthesized and validated to form the analysis used in the study.

Step one of the task analysis was performed during the assessment phase during which the functional skill, shoe-lace tying, was identified. Step two required the performance of the skill to be considered in relation to the child's strengths and needs. Firstly, the physical needs of the children needed to be considered. A number of the children were reported to have fine motor difficulties, which made completing fine motor tasks such as tying a shoelace more challenging. Therefore, the task needed to

be differentiated in a way that reduced these demands. To overcome this, thick shoelaces were used as they are easier to grasp and manipulate (Rayner, 2011). Additionally, a method of shoelace tying that reduces fine motor demands was used. This method has been found to be effective when used with participants who have learning difficulties (Martin, 1971). To further reduce the fine motor demands placed upon participants, they learned to tie the shoe while it was on a table in front of them (rather than on their foot). While this reduces the social validity of the skill, it was felt that the benefit of reducing the motor demands placed on the participant outweighed this disadvantage. Tying shoelaces is also a cognitively complex skill that is likely to challenge the participants, given that they have not yet mastered this skill at their chronological age. Therefore, to reduce the cognitive demands required to carry out the skill, different coloured laces were used to make it easier to distinguish between the different laces of the shoe (Rayner, 2011).

Once the first two steps of the task analysis had been completed, I recorded myself carrying out the skill to allow me to complete a task analysis. I then reviewed the video several times to determine the steps involved in completing the skill. Following the recommendations of Cuvo (1978), this video was shared with a colleague who was experienced in completing task analysis. They created their own task analysis and the results of the two analyses were shared. We then discussed our task analyses and created a task analysis that we agreed was a valid reflection of the skill. The final task analysis for shoe lace tying resulted in a 20-step task analysis (10 for each shoe), as shown in appendix 3.

3.5.2.4 Phase 4: Programme development. Behavioural objectives (Baine, 1982) were used to provide a clear and descriptive statement that outlined target behaviours. The behaviour (i.e. tying a shoelace) and the conditions (i.e. in a

classroom after watching an immersive video) were clear to identify due to the stipulations of the nature of the task and where it could be performed. However, it was unclear as to where to set the mastery criterion. Previous research of video modelling interventions state that the mastery criterion varies from 80% to 100% between studies, and there is no explanation as to why this level has been selected (Akmanoglu, Yanardag, and Batu, 2014; Grosberg and Charlop, 2014). There is some evidence to indicate that a higher mastery criterion increases skill maintenance (Fuller and Fienup, 2018). However there is limited research in this area. Therefore, to adhere to the majority of studies investigating video modelling, I decided that an 80% mastery criterion would be used. It was also unclear as to how long the child needed to be at this criterion before the study ended. Again, there is some variation within video modelling research in relation to this. Kratochwill et al. (2010, however, recommends that mastery criteria should be met at three different points in time. Thus, this criterion was selected to inform the behavioural objective (see Table 11).

The skill was assessed using a task analytic assessment (Snell and Grigg, 1990) in which the task analysis served as an observation schedule (appendix 3) that provided a measure of the children's performance. A single opportunity variation of this approach was used in which participants were given one chance to tie the shoelace after watching the immersive video. Steps needed to be completed in order for subsequent steps to be recorded as correct. Participants were given 20 seconds following an incorrect response to try to realise their mistake and correct it. If they did not correct the mistake, the assessment would end.

Table 12*. The behavioural objectives used in this study (based upon Baine, 1982)*

Aspect of the behavioural objective	**The behavioural objective used in this study**
Behaviour	The child will be able to tie a shoe lace
Condition	In a classroom after watching an immersive video
Criteria	They will get 80% of the steps correct for three consecutive sessions.

Prior to the intervention beginning, a baseline of the participants' current ability was obtained. In line with the AB design, participants were asked to carry out the skill three times without being shown the video to obtain a baseline. During this phase, participants were given positive verbal feedback if they carried out a step successfully. However, they were not given any form of direction (for example, "good" or "well done" is an appropriate response, but "tie the laces next" is not). Participants were also asked to carry out the skill in the generalisation condition before watching the video to ensure that they were not able to complete this skill prior to teaching.

To create the immersive video for the intervention, Samsung Gear equipment was used to create and watch the immersive videos. To record the immersive videos, I set up the required materials to carry out the functional skills in the year 9 classroom where the intervention would take place. I then set up the camera (Samsung Gear 360°) on a tripod and I performed the functional skill remaining at the back of the camera so that only my arms were visible if the participant focussed on the skill being carried out, thus giving the impression of a first-person view. The video was 1 minute and 36 seconds long. Videos were then saved to a mobile phone (Samsung Galaxy S6). This phone was only used for the purpose of this study, and it did not contain a

SIM card or have internet connectivity to ensure that participants were not able to access any data from the telephone or access the internet.

Prior to the start of the intervention all adults who delivered the study were provided with training in delivering the intervention. This included an introduction to the theory, a demonstration of the approach and a chance to practise delivering the intervention (refer to appendix 12 and 13). To set up the immersive video during the intervention, the phone was placed in the Samsung Gear VR headset and adults then followed the appropriate menus within the Gear VR to start the video depicting the target skill, and the video was then paused using the Samsung Gear VR Controller. Adults then passed the headset to the child and asked the child to adjust the headset so that the screen was in focus. Once the headset was focused, the adult would give the child a prompt to look at the target item (e.g. look at the shoe) and play the video. Throughout the video, the adult would monitor the child to ensure that they remained engaged in the video, and they provided verbal prompts if the child appeared to be distracted. They also ensured that health and safety considerations were adhered to (see Section 3.7). After participants had watched the video, they removed the headset and were given sufficient time to re-orient themselves after wearing the headset. They were then asked to carry out the skill. The adult used the observation schedule to record progress within the skill. Children were not given any verbal feedback during this phase. This was repeated for up to 20 sessions or until the child did not demonstrate progress for three consecutive sessions. This rule was put in place to prevent the children from becoming frustrated during the intervention. One session consisted of watching the video and practising the skill. It was essential that there was at least one session per school day, with a maximum of two sessions to reduce the likelihood of fatigue or motion sickness affecting children.

3.5.2.5 Phase 5: Evaluation. The evaluation of the intervention measured skill acquisition (assessed using the mastery criterion) and the rate of skill acquisition (determined by how long it took to reach the mastery criterion). The hierarchy of learning (Haring and Eaton, 1978) was used to determine the extent to which the skill had been learnt. The hierarchy of learning (see Table 12) orders learning into five stages and provides an understanding of how well the skill has been learnt. The first stage of learning (accuracy) is assessed during the normal assessment criteria as this measures a child's ability to carry out a skill without errors. The second stage of learning, fluency (the ability to complete a skill with speed and accuracy), was not assessed during this study. This stage was omitted for two reasons. Firstly, the class teacher advised that being timed would have placed the children under undue emotional stress that would have affected their ability to complete the task. Secondly, it is not known how fast a child who is learning to tie their shoelace should be able to complete this task. To obtain this information a separate study would have had to have taken place with children of the same age who are also learning to tie their shoes; this was beyond the resources available to complete this study. The third stage, maintenance (the ability to complete the skill even after a break in teaching), was assessed two weeks after the intervention. This duration was selected for practical reasons as there was a two-week school holiday following the intervention. Therefore, it was not possible to complete the maintenance assessment prior to this point. The fourth stage of learning, generalisation (using the skill in a different situation as to which it was acquired), was assessed in the session after the participant reached mastery criteria. It was decided that the skill should be generalised in a way that made it more socially valid, so the child was asked to tie their shoelace on their own shoe.

This was recorded using the same observation schedule used during the intervention phase.

Table 13. *The application of The Learning Hierarchy (Haring and Eaton, 1978)*

Stage of the Learning Hierarchy	**Definition**	**How it was measured in this study**
Acquisition	The individual is able to perform the skill accurately although they are not yet fast in completing the skill	Children were asked to complete the skill and observational checklist was used to determine if this was being performed accurately
Fluency	The individual is able to perform the skill accurately and quickly	This was not assessed during this study
Maintenance	The individual is able to retain the skill following a break in instruction	Children were asked to complete the skill after a two week period with no intervention sessions
Generalisation	The individual is able to perform the skill in novel contexts and settings	Children were asked to tie a shoe lace on the a shoe whilst wearing it (as opposed to a shoe on a table during the intervention)

Data obtained via the observation schedule was inserted into a graph and analysed using visual analysis. There is debate within SCED research as to what the most appropriate type of analysis is, which meant that a number of considerations had to be made to determine the type of analysis once the data had been recorded. Smith (2012) states that the type of analysis used is contingent upon the baseline data. He argues that baseline data must be stable, free of trend, and have minimum overlap between the different phases for visual analysis to be used. Alternatively, Kazadin (2010) recommends using statistical analysis if trends are apparent within the baseline data. Inspection of the data obtained during this research indicated that the baseline

data fulfilled the criteria outlined by Smith (2012) and, therefore, a visual analysis was conducted.

3.5.3 Reliability and validity measures. I observed 10 of the sessions carried out by school staff (five sessions by each staff member who delivered the intervention). The purpose of this assessment was to measure the fidelity of the implementation of the intervention and observe whether the observation schedule was completed reliably.

To assess the fidelity of intervention delivery an observation schedule was used that outlined the procedure of the intervention (see appendix 14). This observation schedule was shared with staff during their training session and it was also used to provide them with guidance during the session. I completed this during each of my observations. This resulted in adults being given a score out of 75. Both participants 1 and 2 achieved a score of 75, indicating that the intervention was delivered as intended.

Inter-rater reliability was also measured to determine whether the observation schedule was completed reliably. During my observation, I completed a separate observation schedule in addition to the one completed by the staff delivering the intervention. I then compared my results with the individual who delivered the intervention after the sessions. Each matching response was scored as 1 with 100 being the highest possible score over the five sessions. Participant 1 achieved a score of 97, while participant 2 achieved a score of 98. This indicated high levels of inter-rater reliability that are beyond the 80% level is indicated as the minimum level to conclude good inter-rater reliability (McHugh, 2012).

3.6 Procedure: Qualitative Phase

3.6.1 Data collection. Semi-structured interviews were carried out with the adults following the final intervention generalisation assessment. The interviews aimed to explore the attitudes and experiences of the adults during the intervention to address the qualitative research questions (refer to appendix 15 and 16 for the interview schedule and rationale for questions). Interviews were selected as they offered more flexibility and depth than other approaches such as questionnaires (Tuckman, 1972). This allowed for greater exploration, which, in turn, could permit more detailed theory generation, which was identified as the purpose of the qualitative phase.

The primary purpose of the semi-structured interviews was to gain an understanding of the adult participants' attitudes towards the IVM intervention whilst addressing the research questions. Semi-structured interviews were selected as they created a framework to ensure that I asked the appropriate questions with a view to addressing the research questions (Lincoln and Guba, 1985), while affording me the flexibility to explore the individuals' unique understanding of the phenomenon being discussed (Cohen, Manion, and Morrison, 2011).

Interviews took place in the school's meeting room with participants individually. Interviews were recorded using a dictaphone and were transcribed verbatim following the interview. Data was anonymised during the transcription process; pseudonyms were given to participants, and any information that could be used to identify children or adults was omitted from the transcription.

3.6.2 Data analysis. Thematic Analysis (Braun and Clarke, 2006) was used to analyse data as it offers a clearly defined and transparent process that allows data to

be organised and analysed. Braun and Clarke (2006) outlined a six-step process for carrying out a thematic analysis. This process is described in Table 13.

Braun and Clarke (2006) emphasised the importance of identifying the epistemological stance that the analysis adopts to promote transparency. However, there is a tension between this requirement and the pragmatic paradigm adopted by this research, as pragmatism resists the argument that “the meaning of an event [i.e. data] can be given in advance of the experience [i.e. analysis]” (Denzin, 2012, p.81). To address this concern, Dewey’s (2008) model of enquiry serves the theoretical basis of this analysis as it acknowledges that my experiences and unknowable beliefs will influence data analysis, while the analysis process will simultaneously adjust my beliefs. This model outlines the subjectivity and unconscious processes that influenced this analysis.

A theoretical ‘top-down’ approach to data analysis was used (Braun and Clarke, 2006, p.12). This means that themes were identified through a pre-determined framework. In this instance, the research questions formed the framework and themes were selected based upon their relevance to these questions. This approach was selected as it ensured that the analysis remained focused on the aims of the research. Due to the small number of interviews carried out, a theme only needed to be present within a single interview. Furthermore, data was only analysed at the semantic level (i.e. meaning was taken based on the information directly contained within the transcript). inferences regarding the beliefs of the individual were not included within this analysis.

Table 14. *The application of the six step process described by Braun and Clarke (2006)*

No.	Step name	How this was carried out in this study
1	Data familiarisation	I familiarized myself with the data by carrying out interviews, transcribing data and re-reading data several times prior to analysis (see appendix 17 for transcriptions).
2	Initial coding	55 extracts relevant to the research questions were highlighted and numbered within the transcript (see appendix 18. They were also written onto post-it notes to allow extracts to be organized more easily during data analysis. Extracts were roughly placed into meaningful groups to organize the data (Tuckett, 2005). At this time four codes were identified (see appendix 19).
3	Searching for themes	Codes were then placed into a mind map and considered in more depth to identify overarching themes that linked these ideas and provided a better reflection of the data. A trial and error approach was used in line with the guidelines of Howitt and Cramer (2008). At this stage eight themes were identified (see appendix 20).
4	Reviewing themes	Initial themes were considered based upon Patton's (1990) concepts of internal homogeneity (i.e. all of the codes within a theme relate to the same idea) and external heterogeneity (i.e. separate themes represent different ideas). During this phase larger themes were divided into smaller sub-themes, as recommended by Braun and Clarke (2006). During this phase six over-arching themes were identified, these themes included nine sub themes within them. Themes were presented in two separate thematic maps in accordance with the research question they answered (see Figures 9 and 10 for the thematic map).
5	Naming and defining themes	Themes were named and defined to capture the essence of the data within them. Sub themes were also defined and named
6	Research is reported	Themes are described in relation to the research questions in Section 4.4

3.6.3 Quality assurance. Quality assurance within qualitative research is a divisive topic. Some authors call for the validity criteria of quantitative research to be applied whilst carrying out qualitative research (Morse, Barrett, Mayan, Olson and Spiers, 2002). Others argue that this is not achievable within qualitative research because the tools and methods used in quantitative research are not compatible with qualitative approaches (Cohen et al., 2011). Lincoln and Guba (1985) propose that the concept of 'trustworthiness' offers an alternative to the positivist notion of validity and is suitable for application within qualitative research. Lincoln and Guba (1985, p.290) define trustworthiness as the extent to which "…findings are worth paying attention to". They argue that there are four aspects of trustworthiness which include "credibility", "transferability", "dependability" and "confirmability" (Lincoln and Guba, 1985, p.296). How each of these areas were addressed within this study will now be described.

Credibility. Credibility considers if the interpretation of the researcher reflects the reality of the situation as perceived by other observers. Several features of this research enhance its credibility. First, I had prolonged engagement with the participants as the research took place over a number of months, before and after the study took place due to my role as a Trainee Educational Psychologist within the school. This increased acceptance towards me and reduced participant reactivity during interviews through the formation of a trusting relationship (Robson and McCartan, 2016). Secondly, 'methodological triangulation' was carried out through the use of mixed research methods (Robson and McCartan, 2016), this enhanced the rigour of the study through offering multiple interpretations of the intervention. Finally, member checks were used as an additional means of increasing credibility (Teddlie and Tashakkori, 2009). In this study, this involved presenting adults with the

thematic map at the end of the study and discussing the interpretations within them. This was done informally following prior to the reporting of the findings. Participants agreed with the interpretation of the data and the analysis was not changed during this process.

Transferability. Transferability refers to how transferable the findings of this study are to other contexts. To achieve this, this research report contains a 'thick description' (Teddlie and Tashakkori, 2009) of the participants, context and methods within this study. This allows other research to make informed comparisons between this research and the context in which they are working. The thickness of this description was balanced with practical considerations (such as the length of the report) and ethical considerations (such as the right to anonymity).

Dependability. Dependability refers to the extent to which the process during the research can yield dependable results. To enhance dependability within this study a widely recognised approach to thematic analysis was used (Braun and Clarke, 2006). This used a highly prescriptive step-based approach and adherence to this approach is demonstrated in section 3.6.2.

Confirmability. Confirmability refers to the extent to which the findings can be confirmed by the data. To enhance levels of confirmability, raw data and each step of data analysis are included in the appendices (see section 3.61 and 3.6.2 for a description of this). This allows other researchers to look back and confirm how the raw data align with my interpretations. Furthermore, data analysis is supported with quotes from interview transcripts, which adds further confirmation to any conclusions I make.

3.7 Ethical Considerations

To identify, address, and manage any ethical concerns in this study, the research was submitted for review by the University of Birmingham Ethics Committee (refer to appendix 21). Normal ethical considerations were put in place, such as the right to anonymity, the right to withdraw, informed consent and data protection practices in line with the General Data Protection Regulations (GDPR), the British Psychological Society (BPS) Code of Ethics and Conduct (BPS, 2018) ,and the ethical guidelines from the British Education Research Association (BERA, 2018). This information was shared with adults through a consent form and information sheet and with children, through the verbal delivery of a flexible script that I read prior to the first intervention session.

Moreover, this project presented additional ethical issues on account of the use of HMDs. It was possible that some of the participants may find wearing the HMD uncomfortable or distressing. Therefore, participants were asked to wear a HMD prior to the start of the study to ensure that they were comfortable in using the equipment. In line with their right to withdraw, they could request to remove the headset at any time. Furthermore, if, at any point, they started to indicate persistent discomfort or distress, they could be withdrawn from the study by an adult.

In addition, the manufacturer of the HMD (Oculus) outlined a number of potential risks associated with using HMDs. Some of these risks could be mitigated through the delivery of the intervention. Table 14 describes these risks and how the researcher reduced the likelihood that this risk occurred.

Table 15. *Key risks identified prior to this study and how they were addressed.*

Risk	Response
Falling or become disorientated while using the headset.	Participants will be seated throughout the study.
Facial injury	Participants will be asked to remove glasses before putting the headset on.
Disorientation after wearing the headset	Participants will be asked to remain seated following the intervention until the researcher feels that they have familiarised themselves with the environment.

There were also a number of potential side effects associated with using the HMD. Information from the manufacturer states that 1 in 4,000 users can experience the following severe side effects: severe dizziness, seizures, epileptic seizures, or blackouts triggered by light flashes or patterns (Oculus, 2019). To reduce the likelihood of this risk, individuals who had a history of seizures or epilepsy were excluded from participating in the study. This resulted in one member of the class not being able to take part in the research. It was also possible that participants may have experienced less severe side effects, including: loss of awareness, eye strain, eye or muscle twitching, involuntary movements, altered, blurred or double vision or other visual abnormalities, dizziness, disorientation, impaired balance, impaired hand-eye coordination, excessive sweating, increased salivation, nausea, light-headedness, discomfort or pain in the head or eyes, drowsiness, fatigue, or any symptoms similar to motion sickness (Oculus, 2019). These symptoms are collectively referred to as cybersickness. The member of staff delivering the intervention monitored the child during and after the intervention. If they demonstrated any of the side effects listed above, they would have been withdrawn from the study. At this point, parents would

have been informed, and appropriate medical action would be taken by an appropriately trained member of staff. While these precautions were in place, none of the participants demonstrated any of the symptoms described above during the study.

Chapter 4 - Findings

4.1 Introduction

This chapter begins by presenting the quantitative findings of this study alongside more detailed pen portraits of participants, with the aim of providing an overview of the efficacy of the intervention and answer the hypothesis outlined in Section 2.7. Next, the findings of the thematic analysis conducted in the qualitative phase are presented and key themes defined and described, while the research questions outlined in Section 2.7 are answered. Finally, the findings of both phases of research are synthesised to address the overarching research question.

4.2 Results: Quantitative Phase

Table 16. A summary of participants VBAS3 results and area of need

Participant (names are pseudonyms)	Primary area of need	Chronological Age (Years:months)	Daily Living Skills Standardised Score*	Percentile**
Scott	Communication and interaction (Down Syndrome)	13:11	45	<1st
Ashleigh	Communication and interaction (Down Syndrome)	14:04	30	<1st
Sunil	Social, emotional needs	14:04	101	53rd
Greg	Social, emotional needs	14:03	68	2nd
Andrew	Communication and interaction	13:09	49	<1st

**A standard score is a means of comparing a child's assessment results to peers of the same age. An average standard score falls within the 85 to 115 range. Scores below 70 place a child two standard deviations below the mean and falls significantly below the average range.*

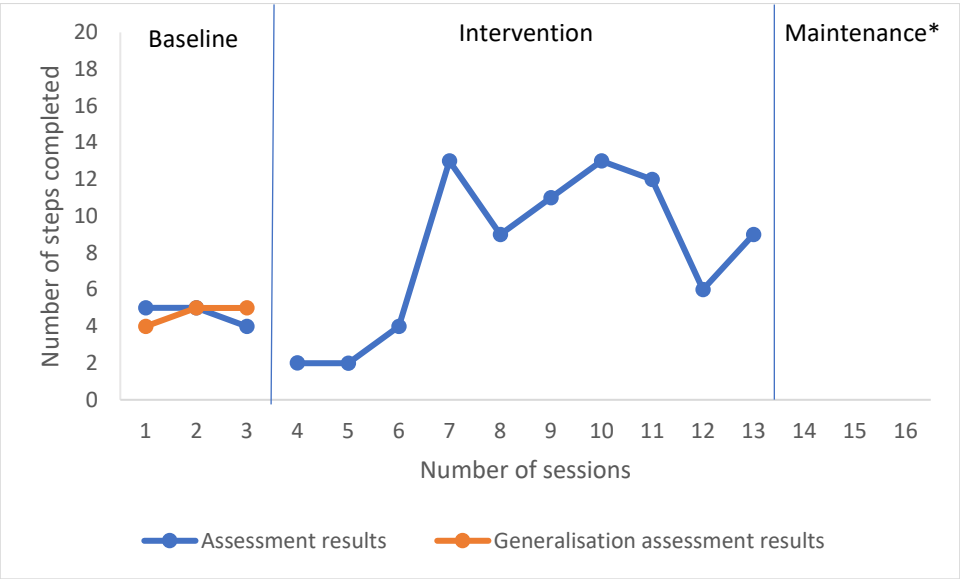
***A percentile is a means of comparing a child's performance on an assessment to peers of the same age. Scores are expressed as a population based percentage to allow easier comparison of children's scores. For example, if 100 children of the same age completed the same assessment a child who fell within the 30th centile would achieve a higher score than 69 other children.*

The results of the VABS3 Daily Living Skills (DLS) assessment (Sparrow, Chicchetti and Saulnier, 2016) indicated that almost all participants had significant difficulty performing daily living skills. The results of the VABS3 are contained in

Table 15. Individual results of the IVM intervention are described below alongside pen portraits for each participant. Information for pen portraits was gained through discussion with school staff. Therefore, it must be noted that information in pen portraits may not be as accurate as information gathered through a multi-agency assessment, however, this information was not available during this study.

Scott is a 13-year-old male. He has Down Syndrome and a number of associated medical, speech, and learning needs. Scott predominantly communicates verbally, but he also uses Makaton to support communication. He achieved a standardised score of 45 on the VABS3 DLS assessment placing him below the first centile, this means that his life skills are significantly below those of other children his age.

Scott's performance during the IVM intervention (Figure 4) indicates that he was able to learn some of the steps required to tie his shoelace during the intervention. However, this learning was not secure and varied between sessions. During the sessions in which he was more successful, he was able to perform two reef knots, and threaded the lace to make the first loop, although he was unable to make the second loop. However, this progress was not maintained over the sessions and his performance fell to near baseline levels in the 12th session. The discontinue criterion was met after 10 intervention sessions. Scott's results indicate that he did not master the target skill during the IVM intervention, although there is evidence that some learning took place.

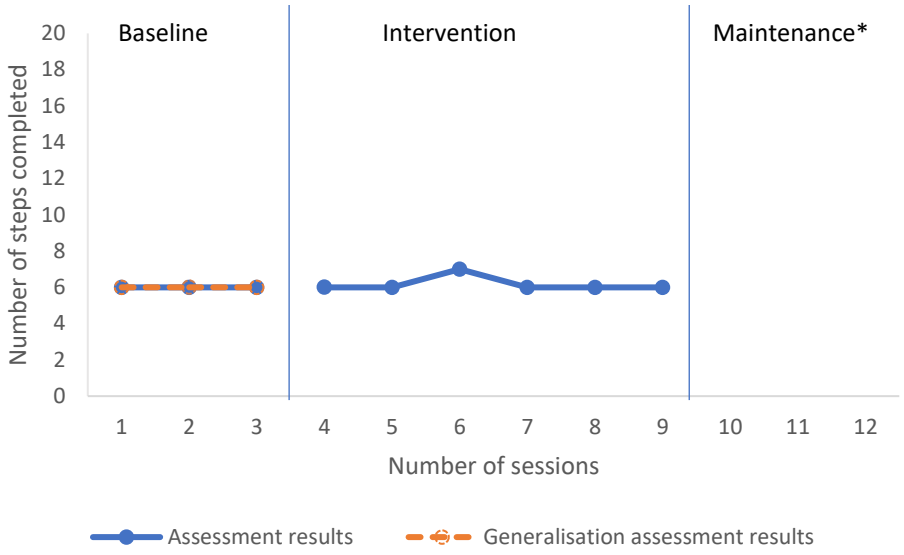


*the participant did not reach mastery criteria and the study was discontinued.

Figure 4. Scott's performance during the IVM intervention.

Ashleigh is a 14-year-old female. She has Down Syndrome and a number of associated medical, speech and learning needs. Ashleigh has moderate learning difficulties and an associated language delay. She also has social and emotional needs and demonstrates high levels of anxiety at times. Ashleigh achieved a VABS3 DLS domain standardised score of 30, placing her below the first centile. This means that her life skills are significantly below those of other children her age.

Ashleigh's performance on the IVM intervention (see Figure 5) shows that she was able to tie a single reef knot at the start of the intervention. However, she did not acquire any further knowledge of the skill beyond baseline levels. Her performance remained consistent throughout the intervention and she met the discontinue criterion after six sessions.



*the participant did not reach mastery criteria and the study was discontinued.

Figure 5. Ashleigh's performance during the IVM intervention.

Sunil is a 14-year-old male. He has high levels of anxiety and low self-esteem, which impacted on his ability to engage in mainstream education. Sunil also has moderate learning difficulties. He achieved a VABS3 DLS domain standardised score of 101. This falls within the average range when compared to children of his age (53rd centile). This means that his life skills are within the average range for a child of his age.

Sunil's performance in the IVM intervention (see Figure 6) demonstrated that he was able to learn the skill through the IVM intervention and he reached the mastery criterion within six intervention sessions. Furthermore, this performance was maintained over time, as he was able to demonstrate these levels of performance following a break from instruction. Sunil was also able to generalise this skill and use it to tie his own shoes. These results show that IVM was successful at teaching Sunil to tie his shoelace.

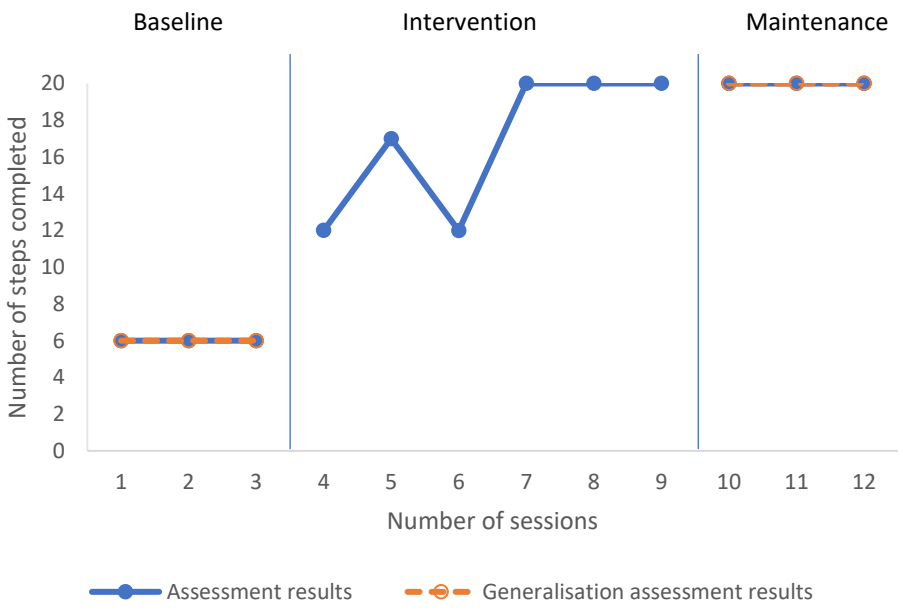
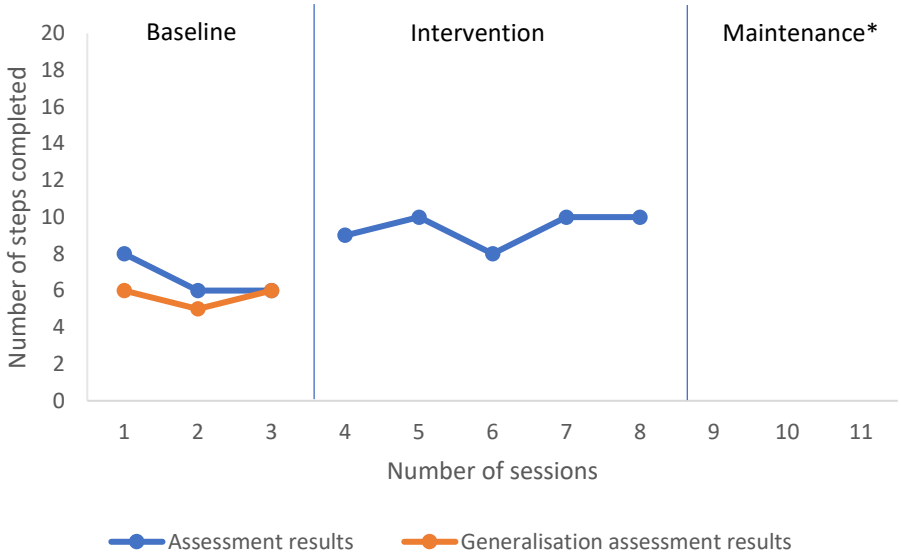


Figure 6. Sunil's performance during the IVM intervention.

Greg is a 14-year-old male. He has a neurological condition that affects learning, emotional regulation, and social communication. Greg has moderate learning difficulties. He achieved a standardised score of 68 on the VABS3 DLS domain assessment placing him in the second centile. This means that his life skills are significantly below those of other children his age.

Greg's performance during the IVM intervention (see Figure 7) indicates that he was able to tie a double reef knot during the baseline phase. However, he continually tied reef knots until he was told to stop and he was not able to create the loops. Greg's performance did not significantly improve from baseline levels and he reached the discontinue criterion within five intervention sessions.



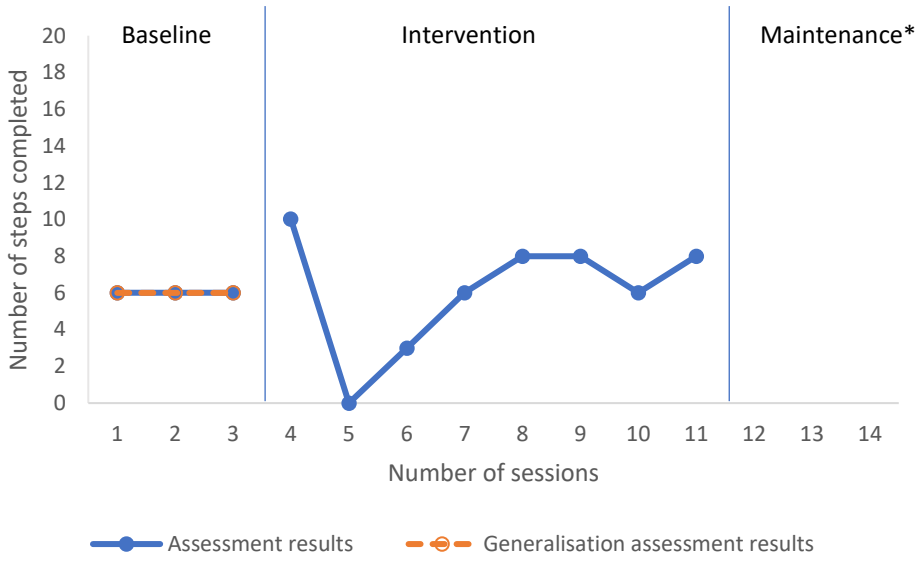
*the participant did not reach mastery criteria and the study was discontinued.

Figure 7. Greg's performance during the IVM intervention.

Andrew is a 13-year-old male. He has expressive language difficulties and dyspraxia (both verbal and motor). He also has moderate learning difficulties. Andrew achieved a VABS3 DLS domain standardised score of 49, placing him below the first centile. This means that his life skills are significantly below those of other children his age.

Andrew's performance during the IVM intervention (see Figure 8) indicates that he was unable to master the target skill during the sessions. His performance was variable, initially demonstrating an improvement in the skill, however this was followed by a significant drop in skill ability before slowly returning to baseline levels. My observations of his performance indicate that he had shown some understanding of what he had seen in the video. During intervention sessions, he continually said "I need to make a hole and put the lace through". This referred to steps 6 and 7. However, Andrew was so focused on these steps that he missed the preceding

steps during sessions 5, 6 and 7, which resulted in his performance falling below baseline levels. Andrew met the discontinue criterion after seven intervention sessions.



*the participant did not reach mastery criteria and the study was discontinued.

Figure 8. Andrew's performance during the IMV intervention.

4.3 Summary of Quantitative Findings

The results of the quantitative phase indicate that the IVM intervention was successful in helping one participant achieve skill mastery. Four participants met the discontinue criterion and three of these participants showed no sustained skill improvements during the intervention phase. Scott was able to show skill acquisition during the intervention, approaching mastery criterion. However, this progress was not maintained during the intervention phase, which resulted in the study being discontinued. Sunil was able to learn the target skill successfully. He responded to IVM quickly and he showed immediate improvements from baseline levels, reaching the mastery criterion within six sessions. Sunil also showed that he was able to

maintain these skills over time and generalise them to be able to tie his shoelace whilst on his foot.

Overall, the findings are mixed; the intervention was effective for one participant. However, the reasons for this are unclear. Sunil was the most able child within the sample (as measured by the VABS3) and it is possible that this was a factor that influenced skill acquisition during IVM. In light of these results, the qualitative phase of this study will aim to identify a reason as to why these results were obtained. This influenced the content of the interviews used during the qualitative phase (see appendix 15).

4.4 Results: Qualitative Phase

Through carefully reviewing the data in accordance with Braun and Clarke's guidelines (2006), and in consideration of the research questions, two thematic maps were produced. Thematic map 1 (Figure 9) represents data that corresponded with research question 1: "What are the experiences of individuals implementing an IVM intervention in regard to the delivery of the intervention and the observed results?". This thematic map contains four themes: "implementation", "generalisation", "presence", and "task". Four sub-themes were contained within these broader themes; subthemes can be seen in Figure 9. Themes and sub-themes are described in Section 4.5.

Thematic map 2 (Figure 10) contains data that relates to research question 2: "What are the participants attitudes towards IVM after delivering an IVM intervention? What are the perceived benefits and disadvantages of IVM?". This thematic map contained two themes: "student attitude" and "staff views". These

themes contained five sub-themes within them; sub-themes can be seen in Figure 10. Themes and sub- themes are described in Section 4.6

4.4.1 Thematic map 1: What are the experiences of individuals implementing an IVM intervention in regards to the delivery of the intervention and the observed results?

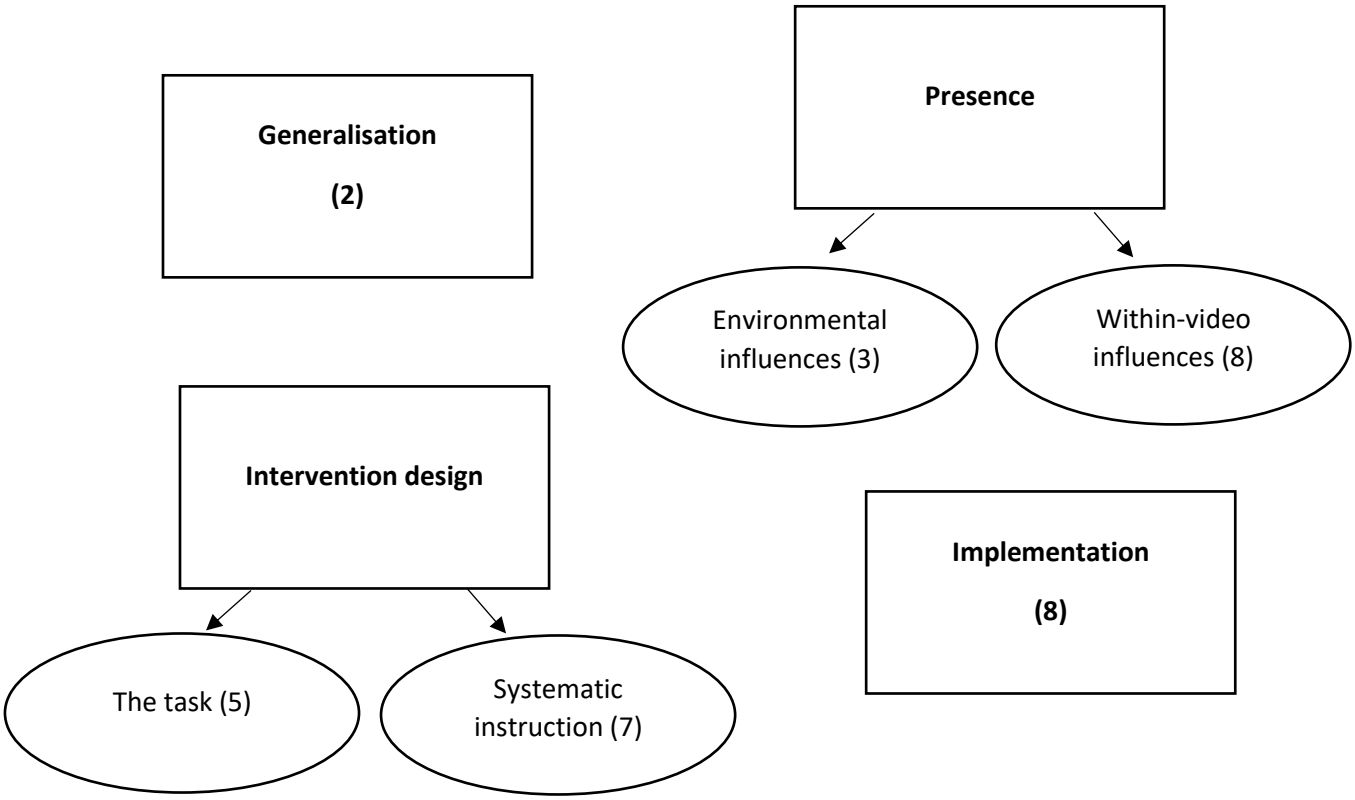


Figure 9. Thematic map to address the research question: What are the experiences of individuals implementing an IVM intervention in regards to the delivery of the intervention and the observed results? (Numbers in brackets refer to the number of extracts in each theme).

4.4.1.1 Theme: Implementation. This theme refers to the practical factors that affected the adults' ability to deliver the intervention. Two participants reported that the intervention was "quite easy to administer" and "easy to understand". They both reported that the procedure given to them during the training was useful, especially the step-by-step instructions. However, one participant reported that setting up the equipment was "confusing", likewise she also found completing the observation schedule difficult. Additionally, the class teacher reported that the intervention was "time-consuming" and took around five minutes to complete with an individual child. This meant that it was not possible to deliver the intervention every day due to staffing difficulties.

4.4.1.2 Theme: Generalisation. This theme contained any references to children using the skills acquired during the sessions in novel settings. All participants reported that they had seen children use these skills outside of the intervention, such as during PE lessons and when putting their walking boots on.

4.4.1.3 Theme: Presence. This theme referred to references of children being present, focused or engaged within the VE. Staff discussed a number of factors affecting presence. To provide further distinction within these factors two sub-themes were identified within this theme: "environmental influence on presence" and "factors influencing presence within the video".

Sub-theme: Environmental influence on presence. This sub-theme contains data that discusses factors that could have affected the participants' presence within the video; this sub-theme excluded any reference to the equipment used. Participants noted two key factors that influenced levels of presence. Firstly, they observed that children were distracted by the other children in the classroom whilst

the intervention was delivered, particularly Scott, who was “concerned about what was going on behind him”. One adult recommended that, in future, it would be better to deliver the intervention in a quiet room outside the classroom. It was also noted that Ashleigh found it challenging to remain focused for two sessions and it was felt that the video was too long which affected her levels of presence.

Sub-theme: Factors influencing presence within the video. This sub-theme relates to data that describes the participants’ levels of presence due to factors relating to the video or HMD. Two participants reflected that the use of the headset increases the levels of presence as it makes you “…feel like you are actually in a different place”. One participant felt this made it “easier for [children] to focus”. Children also liked the fact that that they could look around. However, this appears to have been problematic within this intervention. One participant noted that “they could see behind them… that may have been a distraction”, especially as classroom staff were present while the video was made and, consequently, students could see them within the intervention video. One participant noted that as children got used to the intervention and showed more focus over time, this took around two sessions for most children.

4.4.1.4 Theme: Intervention design. This theme referred to the way that the intervention was designed. The theme was broken down into two smaller sub-themes as feedback related to two clear aspects of the intervention: “the task” and “systematic instruction”

Sub-theme: The task. This sub-theme describes the design of the task (i.e. tying a shoelace) and the technique and methods that children were asked to use during the intervention. All participants reported that the method used to teach the

skill “was a bit complicated” and it could have been confusing, especially if they had started to learn a different method before. One participant noted that the narration could have been changed to include language that children understood, such as using the term “bunny ears” rather than “loops”.

Sub-theme: Systematic instruction. This sub-theme describes data that refers to the overall structure of the intervention as determined through the use of systematic instruction. All participants felt that the videos presented the children with too many tasks at once, and that they needed to be broken down into smaller steps. One participant felt that children should have been able to select the method that was used to tie shoelaces. Meanwhile, all participants agreed that the videos should have been based upon the method that children had previously been taught, building on children’s previous knowledge. This would have required individual videos, which two participants noted as being advantageous.

4.4.2 Thematic map 2: What are the participants attitude towards IVM after delivering an IVM intervention? What are the perceived benefits and disadvantages of IVM?

4.4.2.1 Theme: Staff perception of students’ attitudes. This theme contains data that describes participants’ perceptions of the students views. To provide greater distinction within this theme, two sub-themes were created: “attitude towards technology” and “attitude towards the intervention”.

Sub-theme: Attitude towards technology. This sub-theme refers to the participants’ perceptions of the children’s attitude towards the technology used within the IVM intervention. Participants reported that almost all of the children found the use of technology “exciting” and “engaging”. Children “liked the headset” and they

"were excited because it is like gaming". It was also noted that the technology was a novel experience as one participant noted that "I don't think that they [the children] have come across this sort of thing before". However, one child did not want to use the headset (because of this they were not included within this study). The reasons for this were not clear, although it was noted that he can be anxious around new things, which possibly contributed towards this decision.

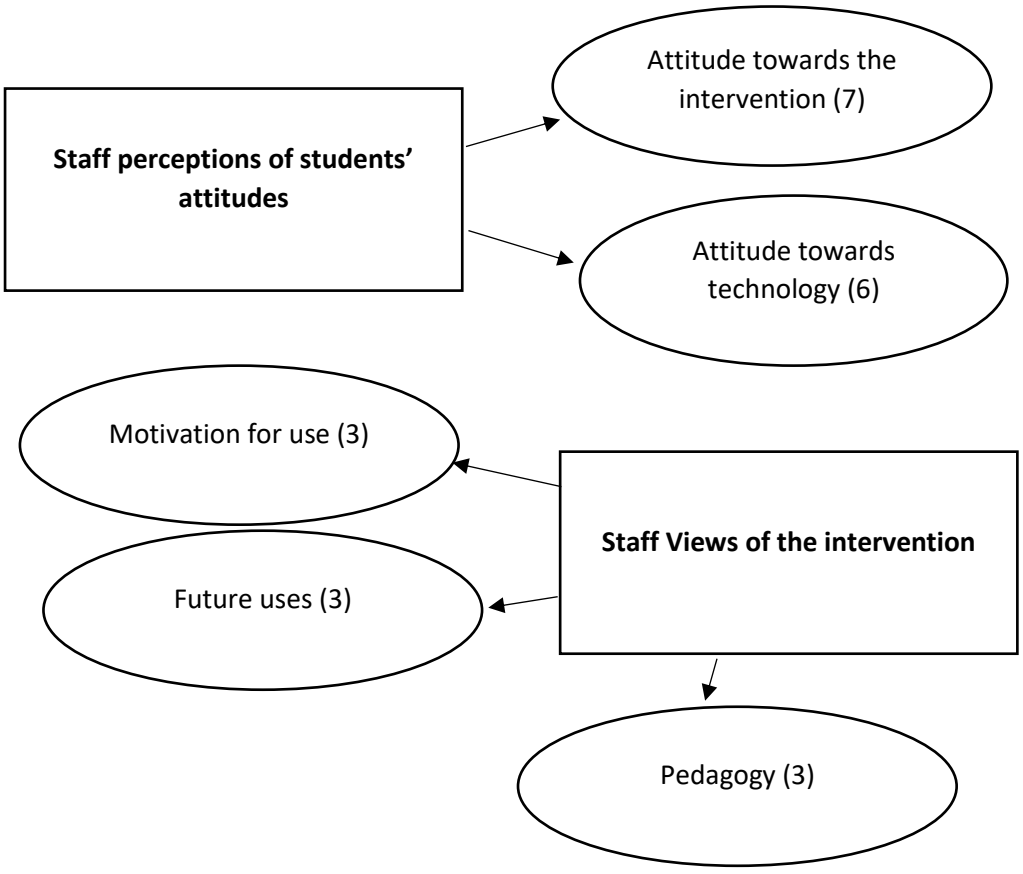


Figure 10. Thematic map 2 to answer the question: What are the adult participants' attitude towards IVM after delivering an IVM intervention? What are the perceived benefits and disadvantages of IVM? (Numbers in brackets refer to the number of extracts in each theme).

Sub-theme: Attitude towards the intervention. This sub-theme refers to the participants' perceptions of children's attitudes towards the IVM intervention. This excludes attitudes that relate specifically to the technology used. One participant reported that "students enjoyed the process". Similarly, another participant saw that most children "become more confident during the intervention because they wanted to succeed". This was especially useful for the child who mastered the skill (Sunil) as it provided him with the "reassurance" that he could complete the skill. However, it was also noted that "there were a few frustrations on the way because [children] want results quick sometimes". Similarly, one child (Scott) "wasn't very motivated… he found it quite boring". Participants noted that this was likely because "he never had to use the skill", while another felt that this was just this child's nature.

4.4.2.2 Theme: Staff views of the intervention. This theme contains data regarding the views and opinions of staff regarding IVM. This theme contains opinions and views that did not fall within other themes. The data within this theme varied, so three sub-themes were created to provide further structure. These were: "pedagogy", "motivation for use" and "future uses of IVM".

Sub-theme: Pedagogy. This sub-theme contains data that refer to the adoption of a specific pedagogy. None of the participants discussed pedagogy explicitly. However a number of extracts seemed to suggest that participants believed IVM aligned with a specific pedagogy. Two participants referred to IVM as being game-like and fun, which increased motivation: "it's a fun thing… they feel like they are watching it through a game, it's quite exciting". This suggests that they feel that the intervention appears to align with gamification to some extent. Another participant valued the independence that IVM offered: "they are watching the video and doing it

themselves", which suggests that IVM provides the opportunity for children to learn independently.

Sub-theme: Motivation for use. This sub-theme contains data that describe participants' motivation for using IVM in the future. One participant noted that "it is a whole new way of learning… I haven't seen anything taught in that way, so I quite enjoyed that". Another noted that "it is good to incorporate something modern that they use at home". These findings underlined the fact that the modern and novel approach used by IVM appears to be appealing to classroom staff.

Sub-theme: Future uses of IVM. This sub-theme contains any references to future applications of IVM. One participant felt that it could be useful to use it to teach writing single words. Similarly, two participants thought that it could be useful for transitions to a new place as it allows you to "see a place numerous times before you go" and "[being able to see a new place] would be useful because it actually feels like you're in a different place". It was thought that being able to see a new place may be especially useful for children who experience anxiety associated with visiting new places.

4.5. Synthesis of Qualitative and Quantitative Data

To guide the synthesis of both phases of data collection, data was considered in relation to the overall purpose of the study. The purpose of this study was to determine the efficacy of IVM whilst considering the practicality of its application in a secondary specialist setting.

The findings of the quantitative phase of the study indicate that the IVM was effective at teaching the target skill for one participant. This resulted in maintenance

and generalisation of this skill. The qualitative findings of this intervention offer further support to these findings as they confirm that generalisation was observed in a number of settings following the intervention.

However, four of the participants failed to reach the mastery criteria. The quantitative phase failed to provide any insights as to why these children did not progress within the intervention, although qualitative findings offered a number of valuable insights in this regard. Firstly, adult participants noted that the method used to tie the shoe did not match the method that children were familiar with; this was confusing. Secondly, the presentation of the skill required children to learn the whole sequence at once, rather than giving them an opportunity to apply the skill after each step. Thirdly, it was noted that some children were distracted by the adults in the video and by other distractions within the classroom during the intervention. This had a negative effect on presence and may have affected skill acquisition. It is possible that all of these factors contributed towards the results obtained within this study.

Despite the mixed findings obtained during the quantitative phase, adult participants were positive about the intervention and all agreed that they would use it again in other formats. They also reported that most students were engaged by the intervention and found it enjoyable. Children enjoyed the use of technology and adults appeared to value its potential to create game-based interventions and increase independent learning opportunities.

One adult reported that the intervention was difficult to deliver and confusing. However, the same participant was observed during the fidelity checks and inter-observer agreement checks and she was found to administer the intervention competently within both of these sessions. This suggests that her reports may be a

reflection of her perceived confidence, rather than her actual skill at delivering the intervention. Likewise, one participant reported that they found it difficult to find the time to deliver the intervention daily. However, no intervention sessions were missed during the intervention period, which indicates that staff were able to deliver the intervention on a daily basis before children reached the mastery/discontinue criteria.

Overall, the synthesis of the quantitative and qualitative phases provides a richer picture of the efficacy of IVM, as well as the experiences of those delivering the intervention. Although the findings of the quantitative phase are mixed, the qualitative data provides a more optimistic interpretation of the applications of IVM. Staff appeared to value the intervention and they hope to use it in the future to support transitions to new places.

Chapter 5- Discussion

5.1 Introduction

This chapter begins by providing an overview of the findings obtained in this study. Next, the viability of IVM is discussed, and a number of hypotheses are presented to offer a potential explanation for these findings. These hypotheses should be investigated further in future applications of IVM. Additionally, the effects that the use of the 360° videos and HMDs had on presence are discussed, before considering some of the practical issues encountered when making the 360° videos. Similarly, the use of 360° video in schools is discussed along with reflections on the range of pedagogic practices that underpin the use of 360° video and VR.

5.2 Overview of Findings

The findings of the qualitative phase of this study were mixed. There is some evidence to support the first hypothesis that “immersive video modelling will allow participants to master target skills”, since one participant was able to master the skill during the intervention. However, the other four participants failed to reach skill mastery. Likewise, there is some evidence to support the second and third hypotheses that: “immersive video modelling will lead to increased generalisation of skills”, and that “Immersive video modelling will result in skills being maintained following the intervention”, as one participant was able to maintain and generalise the skills that were taught during IVM. However, as with the first hypothesis, four of the participants were not assessed for maintenance and generalisation as they were unable to master the skills during the intervention. The partial confirmation of these hypotheses suggests that IVM may be an effective intervention for some individuals. However, the factors that contributed to the success of this participant are unclear from the results of the quantitative phase. Potential influences are discussed in Section 5.3. It must

also be noted that a confounding variable may have resulted in Sunil mastering the skill, for example additional instruction. This was discussed with staff delivering the intervention. Children did not receive any additional instruction whilst at school, and while it is possible that participants received additional instruction at home, this instruction is very unlikely to have used the adapted technique taught in this intervention. During staff interviews, it was noted that children may have been confused by the use of a new approach, and contradictory instruction outside the intervention is likely to have increased this confusion. This could have had a negative effect on the other children's performance.

The research questions answered during the qualitative phase are described fully in Chapter 4. The thematic analysis identified four themes to address research question 1: "What are the experiences of individuals implementing an IVM intervention in regard to the delivery of the intervention and the observed results?". These themes were: "presence", "implementation", "intervention design" and "generalisation". Additionally, thematic analysis identified two overarching themes that addressed research question 2: "What are the participants' attitudes towards IVM after delivering an IVM intervention? What are the perceived benefits and disadvantages of IVM?". These themes were: "student attitudes" and "staff views".

Integration of the quantitative and qualitative phases occurred within Section 4.5. The qualitative phase provides greater insight regarding the results of the quantitative results. This is described in Section 4.5.

5.3 Viability of IVM

The results of this study provide some evidence as to the efficacy of IVM. The findings demonstrate that IVM can be an effective intervention for teaching shoelace

tying; however, it does not appear to be effective for everyone. There are multiple hypotheses as to why the results of this study were inconsistent, and these potential explanations are elaborated further in this section.

5.3.1 Individual differences. Firstly, it is important to note that the sample were varied in terms of their individual difficulties and strengths. Three participants (Scott, Ashleigh, and Andrew) were reported to have difficulties with fine motor skills. Given the nature of the task, it is possible that they lacked the prerequisite motor skills necessary to tie shoelaces which impacted on their performance. This is especially likely for children who have Down Syndrome due to the motor difficulties, processing delays and slower response times associated with this condition (Carvalho and Vasconcelos, 2011). Motor skills were not formally assessed as part of this study due to the unavailability of appropriate assessment tools. Therefore, it is unclear as to how developed participants' fine motor skills were, and to what extent this impacted skill acquisition. This is a limitation of this study.

Additionally, Sunil performed significantly better than his peers in the VABS3 DLS domain assessment. Interestingly he was the only participant to master the skill, and it is likely that he possesses a number of prerequisite cognitive skills that allowed him to access IVM. Literature suggests that imitation is cited as a key prerequisite skill for being able to access video-based interventions (Macdonald, Dickson, Martineau and Ahern, 2015). Staff reports was used to ensure that children had sufficient imitation skill. However, this assessment measure failed to provide an objective measure of a child's imitation skills. It is possible that some children had better imitation skills than others and that this contributed towards their performance. Likewise, performance on a delayed match to sample test has also been cited to predict performance in video-based interventions (Macdonald et al., 2015). This

assessment was not available during this study, and it is therefore possible that some participants did not have the pre-requisite skills within this domain to access a video-based intervention. Furthermore, non-verbal ability has also been found to be a mediating factor in the acquisition of skills through a VE (Purser et al., 2015), although the impact of this was not investigated during this study. Therefore, future research should consider the influence of these skills when delivering IVM-based interventions and explore individual differences that could impact upon performance within IVM-based interventions.

Furthermore, children within the study were diverse in terms of their SEND. It may be possible to begin to compare participants based upon their areas of SEND to determine whether this influenced performance. However, the literature review demonstrated that VEs have been found to be useful for individuals with a range of SEND, including physical disability (Hesdai, Jessel, and Weiss, 1999), hearing impairment (Eden, 2008), SLDs (Cobb et al., 1998), ADHD (Negut et al., 2016) and ASCs (Chang, Huang and Yang, 2015). This indicates that the applications of VEs are wide-ranging. Due to the small sample size used in this study, it would be unwise to attempt to generalise these findings to groups of children with specific SEND. Furthermore, I would caution future researchers from attempting to generalise the research regarding video-based interventions to entire groups of SEND children for two reasons. Firstly, these groups are heterogeneous and comprised of individuals with varying strengths and difficulties (for example, Masi, DeMayo, Glozier and Guastella, 2017) discusses the heterogeneity within ASCs). Secondly, there is evidence to highlight individual differences that impact on access to video-based interventions (such as non-verbal ability, Purser et al., 2015 and imitation skills Macdonald et al., 2015). These individual differences are likely to provide the best

indication of the viability of a video-based intervention, such as IVM rather than groups of SEND.

5.3.2. Intervention structure. Data from the qualitative analysis showed that staff felt the structure of the intervention could have placed the child participants at a disadvantage. It was suggested that children were presented with too many steps at once. This feedback indicates that the chaining procedure used within this study was sub-optimal. This study used a whole chaining procedure (presenting the entire chain of skills before asking the participants to complete the skill), whereas staff advised that a part chaining procedure could have been more effective (allowing participants to watch the video for an individual step and allowing them to practise the skill one step at a time). This contradicts the taxonomy proposed by Naylor and Briggs (1963), who report that individuals are able to acquire organised tasks (tasks that have inter-dependent steps as is the case with lace tying) better when they are presented in their entirety. There is currently no research to examine the use of part forward chaining (teaching the skill in the order in which it is carried out) to teach shoelace tying. However, Raynor (2011) compares the use of back chaining (teaching the final step of the skill first and then gradually moving towards the first step) and a forward chaining to teach shoelace tying through the use of a multiple baseline design. Raynor concluded that back chaining resulted in greater skill acquisition. However due to the design used, participants had already received a forward chaining intervention for the same skill. This is likely to have affected the validity of any comparisons made between the approaches. Therefore, it is currently unclear whether part chaining or back chaining is a more effective means of teaching shoelace tying. This is an area for future investigation.

After the intervention had ended, staff used an in-vivo modelling approach involving part forward chaining and prompting to teach the skill to the children who had not reached mastery. The results of this intervention were not recorded using an observation schedule and were beyond the scope of this study. Anecdotal reports from staff indicated that Ashleigh was able to learn the skill through the use of this approach. These reports could be an indication that both forward chaining and prompting may be a more effective approach than whole chaining alone. Prompting has been suggested as a way of increasing the efficacy of PVM interventions, (Mason, et al., 2013). Likewise, Mason et al. (2013) advise that forward chaining is a more effective means of delivering PVM interventions. However, there is little consensus within the literature as to which chaining approach is more effective (Cooper, Heron, and Heward, 2007). Yet, it is my opinion that IVM is not compatible with part chaining as participants would be required to continually remove and reapply the headset, which seems too impractical to make it a feasible intervention.

5.3.3 Shoelace tying technique. Qualitative findings indicated that adult participants felt that the method of tying shoelaces used in this study was more complicated than the most common method (that involves forming two loops and then tying them together in a knot). They also suggested that teaching the children using the most common method would have meant that children could have used their prior knowledge in approaching the skill. Recent studies of shoelace tying (Rayner, 2011; Richard, 2017) both used a conventional method combined with back chaining in their approach. The studies reported that some participants were unable to acquire and maintain the skill, which suggests that factors other than the shoelace tying technique influence skill acquisition. Furthermore, this approach has been

found to be effective in other studies at teaching children with learning difficulties (Martin et al., 1981), which suggests that its use was appropriate.

5.4 Presence and Immersion

This intervention demonstrated high levels of immersion within the extensive, inclusive, surrounding, and vivid domains outlined by Miller and Bugnariu (2016). It also provided moderate levels of matching (refer to Table 2 for a description of these domains). Overall, the approach used provided high levels of immersion in line with Miller and Bugnariu's (2016) criteria, although, increased immersion does not necessarily lead to higher levels of presence (Slater,2003).

Interviews with staff suggested that children experienced increased presence whilst using the immersive technology, reflecting the findings of existing research (Freina and Ott, 2015). Despite this, my observations indicate that this level of presence detracted from the children's ability to engage with the task during the early sessions. Children were very distracted by other features of the VE, and they tried to interact with the VE by reaching out and trying to grab items that were visible within the VE. They also demonstrated high levels of excitement, by shouting and discussing things that they could see; these behaviours could suggest high levels of presence and enjoyment. Similarly, Rupp et al. (2016) reported that their participants paid less attention to narration while immersed in VR, and they hypothesised that this was due to high levels of presence within the visual environment. The findings of this study and Rupp et al. (2016) appear to indicate that being too present in an environment may detract from the learning task, as the participant is unable to maintain their attention to the learning task. This is likely to be an even greater barrier for individuals with attentional difficulties who have been found to find it more challenging to perform tasks within VEs (Negut et al., 2016). However, as

participants became more accustomed to the VE, they were able to focus more and staff reported that they saw higher levels of focus than the child normally demonstrates. This indicates that, once the user has become accustomed to the VE, they are able to focus on the task more. It may be that the novelty of being in a VE initially can be overwhelming, and once participants become accustomed to VEs, they are able to engage with the learning task more efficiently. This should be investigated in future research.

Formal assessments of presence were not carried out during this research (such as the presence questionnaire by Slater, Usoh and Steed, 1995). This is because the written assessments used to measure presence were developmentally inappropriate for the participants of this study. Furthermore, the concept of presence is very abstract, and I anticipate that it would be challenging for a number of the participants to contemplate such abstract concepts and, therefore, it would have been very challenging for them to discuss these. It is possible to use more objective physiological measures to measure presence, such as functional Magnetic Resonance Imaging (fMRI) (Clemente et al., 2013), heart rate, and electrodermal activity (Egan et al., 2016). However, the tools required to measure these areas were not available during this study.

5.5 Production and Delivery of the 360° Video

The production of the 360° video was mainly based on a trial-and-error approach. There is very little guidance that discusses how to make a good 360° video, although it must be noted that Kavanagh, Luxton-Reily, Wuensche and Plimmer (2016) provide a number of useful insights. Initially, the camera was held in my hand during recording, which resulted in the video being unstable and increased feelings of motion sickness. It also led to the ‘giant hands’ phenomenon (Kavanagh

et al., 2016) in which the hand holding the camera is enlarged due to its proximity to the lens. To overcome these difficulties, the camera was placed on a static stand during video production. This provided stability, but reduced manoeuvrability. Ideally, a gimbal (a device that is used to stabilise a camera) could be used to overcome these limitations, however, this adds to the cost of the equipment and was beyond the resources available within this research.

As noted by Kavanagh et al. (2016), video quality was also problematic. While the camera recorded in 1080p (which is HD quality on a traditional display), when applied to a 360° field, pixels were stretched, which significantly reduced the quality of the video. This did not detract from the ability to see the skill in this instance; However, this could be problematic if participants were asked to perform skills that required them to see smaller objects, such as reading a sign. Higher video quality can be achieved through a higher quality camera or multiple cameras (such as the Go Pro Omni used by Harrington et al., 2018). However, the use of higher quality equipment would also increase the cost of the intervention significantly.

The biggest barrier to delivering this intervention using the Samsung Gear VR is that adults cannot see what children are looking at whilst participants are wearing the headset. This required adults to wear the headset to get the video ready before passing the headset over to the participants and starting the video using a remote control. This was because adults could not see what was displayed on the HMD whilst the child is wearing it, and the children were unable to start the video themselves. Furthermore, adults had to use their knowledge of the video to make sure that children were directing their head to the correct part of the video. Again, this would have been more effective if they could view a copy of the display on a separate monitor. This limitation is best demonstrated by an incident that occurred

during the intervention during which a child was presented with a video that depicted another skill being carried out. This child watched the entire video before indicating that he had watched the wrong video. This could have been prevented if the adult could have seen a copy of the display on a separate monitor. Therefore, this is a useful area to consider when selecting a VR device for application in education.

None of the children experienced motion sickness during the study, although one child communicated a feeling of disorientation when taking the headset off. The absence of negative side effects is likely due to the camera being placed in a static position on a tripod while the video was made, which reduced camera movement (LaViola, 2000). Both myself and colleges experienced feelings of motion sickness whilst viewing earlier videos that were made in the development of this video, which confirms that this technology can induce cyber sickness (as reported elsewhere, Oculus, 2019; Johnson, 2018). Therefore, based upon my experiences within this study, it appears that cyber sickness can be prevented if camera movement is reduced as much as possible.

5.6 Use of 360° Video in Schools

These findings indicate that 360° video can be used successfully in a specialist educational setting. The qualitative phase indicated that both staff and students were motivated to use the technology and were interested in using it again. Following this intervention, one of the members of staff involved in the study recorded her own shoelace tying video to support another child in the school. This suggests that, once initial training has been put in place and the equipment has been purchased, videos are relatively easy to create. This is especially noteworthy as this member of staff only had a 10-minute training session on how to use the camera before making the video. Kavanagh et al. (2016) illustrated how 360° video can be

made without specialist training, which supports the idea that these videos are relatively simple to produce. Although, the literature review did not identify any published research that involved training others to create and use VEs, this finding supports the assertion that staff are able to create VEs without specialist skills (Jensen and Konradsen, 2018). Additionally, staff were able to consider new ways of applying 360° video and were interested in using it to allow children to see pictures of the upcoming residential trip to an outdoor activity centre. It was hoped that this would reduce the anxiety that children had expressed about the trip. VEs have been found to significantly reduce anxiety associated with agoraphobia (Botella et al., 2007) and, therefore this application of 360° video aligns with the existing research base into their application. This demonstrates the versatility of 360° video in education and outlines that there are potential uses beyond those discussed in this project.

5.7 The Pedagogy of 360° Video Interventions

Systematic instruction was used to provide the pedagogical foundations for this intervention, and this offered a number of benefits. Firstly, it allowed instruction to be designed in an optimal way that drew upon existing evidence and theory such as CTML (Mayer, 2009). It also allowed instruction to be designed in a way that was considerate of the participants' developmental abilities, rather than pre-determined criteria based upon a child's chronological age. Similarly, it allowed progress during the intervention to be measured in objective terms through the use of a task analysis and observation schedule. The qualitative findings indicated that staff valued this approach to progress monitoring. Therefore, the application of systematic instruction offers a number of benefits that enable instruction to be delivered in a way that can be optimised and evaluated through behavioural indicators (Collins, 2012).

However, systematic instruction is not the only pedagogy that can be applied to the use of 360° video. Literature suggests that VR-based approaches can be used as a tool to implement a number of pedagogical approaches, including constructivism, gamification, collectivism, and experiential learning (Kavanagh et al., 2017; Johnston, Olivas, Steele, Smith and Bailey, 2018). However, in a content analysis of existing VR applications, it was noted that a pedagogical foundation was unclear in 17 of the 35 applications examined (Johnston et al., 2018). The authors of this analysis emphasised the importance of having clear pedagogical foundations upon which VR-based interventions can be applied. Similarly, Mannion (2018) found that some teachers felt that VR-based applications did not align with the existing curriculum and teaching practices within schools. It was noted that this is partly because technology companies who design such software do not have the experience within the educational profession to employ these ideas. It is therefore essential that individuals who design VR-based interventions employ pedagogic principles when creating applications. There are a number of studies that show the viability of a range of pedagogies that can be applied through the use of VR (see Johnston et al., 2018 for a review). Furthermore, the content of these applications should align with a curriculum to ensure their benefit to educators (Mannion, 2018). It is important that theory is applied to the design of VR-based approaches since, without this, there is a risk that the educational potential of VR could be overlooked in favour of novel experiences and gimmicks that are driven by technology companies, rather than educational theory and evidence-based practice (DfE, 2019).

Chapter 6 - Conclusions

6.1 Introduction

In this chapter, the potential strengths and limitations of IVM are outlined before the overall limitations of the research project are discussed. This chapter then proposes a number of implications of this research for education professionals and EPs, as well as future directions for the use of IVM and 360° video in education.

6. 2 Strengths of IVM

The most noteworthy and unique benefit of IVM and 360° video is that it allows the production of VEs that are incredibly detailed and replicate real-life environments (Kavanagh et al., 2017). Other approaches to VEs do not allow the production of such realistic environments in such a short period of time and with such little skill. This means that anyone can produce a VE using a 360° camera with very little training (Kavanagh et al., 2016). Furthermore, VEs can be made that depict the exact environment in which the individual is expected to carry out the skill. It is reasonable to assume that this reduces the degree of generalisation required to be able to apply the skill after seeing it performed in the video (although future research should seek to verify this hypothesis).

Due to the use of video, IVM shares a number of benefits with VM-based approaches, including the fact that it allows target skills to be presented consistently without error, videos can be re-watched as many times as the participant chooses, and videos can be watched independently without the help of an adult (provided that participants can operate the equipment independently). Likewise, the procedure of IVM is closely aligned to that of PVM (Shukla-Mehta, Miller, and Callahan, 2010). However, it offers the additional benefit of having a larger field of view due to the headsets ability to adjust its view based on head movements. This overcomes this

limitation of PVM, and it allows point-of-view video to be used in a wider array of situations (for example, scenarios where participants are required to use visual scanning skills such as looking for an item in a shop). IVM also offers increased levels of immersion through the use of HMDs, which are likely to increase presence, motivation, and enjoyment (Freina and Ott, 2015; Rupp et al., 2016).

Furthermore, IVM offers a number of practical benefits, especially in relation to the development of life skills. It has already been noted that access to the community to practise life skills poses a number of time, staffing and safety challenges, especially when delivered within an educational context. IVM shares a number of strengths with other VE-based approaches in this way as it offers participants the opportunity to begin to acquire community-based life skills whilst remaining safe and being in an environment that negates the negative social consequences of failure (Tzanavari et al., 2015; Negut et al., 2016). However, it is not yet known whether IVM is an effective medium of teaching community-based skills, and It is therefore essential that further research is carried out in this area.

Furthermore, IVM presents information in a way that is highly visual. This should play to the reported strengths of children with ASCs (Bozgeyikli et al., 2018) and other conditions that are associated with greater engagement with visual learning approaches, such as Down Syndrome and Williams Syndrome (Purser, 2015). However, this study did not include any participants with ASCs, and it is possible that participants with Down Syndrome did not have the prerequisite motor and cognitive skills to access this intervention. Future research should investigate the use of IVM with participants who have ASCs, and the pre-requisite skills of participants should be assessed prior to the intervention.

6.3 Limitations of IVM

IVM is restricted as to whom it can be used with due to health and safety considerations (Oculus, 2019) and the personal preferences of individuals. During this study, two participants were excluded, one on health grounds, and the second chose not to wear the headset. This is a practical and ethical limitation of the use of this technology. From a practical standpoint, staff have to find alternative means of presenting the intervention. During this study this was achieved by presenting the video through the phone screen without the VR headset. However, this leads to the ethical limitation in that participants were receiving a different intervention. The child who could not participate on medical grounds appeared frustrated by this as she was unable to gain access to the provision her peers received. The second child also appeared conscious that he was receiving a different intervention, and he appeared less motivated to take part because of this. Consequently, it seems that the use of HMDs resulted in some children feeling different from their peers, which affected them negatively.

6.4 Limitations of this Research

The most significant limitation of this research is the absence of a valid comparison group. The use of SCED allowed participants to act as their own control measure. However this failed to provide an indication as to how IVM compares to other methods of instruction. This is an important consideration to make as other studies examining shoelace tying have also reported that some participants were unable to master skills during the intervention period (Rayner, 2011; Richard, 2017). Therefore, it appears that none of the published approaches that aim to teach shoelace tying have a 100% success rate. Consequently, the findings of this study

only provide an indication as to how individual participants performed using IVM and it does compare IVM to other approaches to delivering life skill instruction.

Secondly, due to the small sample sizes used in this study, the findings are limited in the extent to which they can be generalised. Additionally, participants were recruited from a generic special school and all were reported to have moderate to severe learning difficulties. This sample did not contain more cognitively able participants who may also benefit from this type of intervention and, therefore, these findings are unlikely to reflect the use of IVM with more able children or in a different setting, such as primary schools, post-16 settings, mainstream schools, or other types of specialist provision.

Additionally, the observation schedule used in this study was a further limitation since, at times, it did not fully reflect a child's performance in the early stages of skill acquisition. Observations indicate that the performance of children was inconsistent between shoes during the same session. For example, in Greg's final session, he was able to reach step 6 on his second shoe; however, he only reached step 4 on his first shoe. This was the first time that he had reached step 6 and suggested that he had made progress. However this progress was masked by the scoring system used in this study and resulted in him scoring a 10. This matched his previous scores and met the discontinue criteria. Therefore, the way in which the observation schedule was administered could have resulted in the intervention ending prematurely. This limitation can be overcome by reporting the results of the observation for each shoe separately in future research. Furthermore, the discontinue criteria used in this study may have withdrawn participants from the study too soon. Collins (2012) recommends continuing intervention until the criterion is reached. Other studies of shoelace tying have reported that it takes up to 131

sessions to reach the mastery criterion (Richard, 2017). However, there was insufficient time in this study to continue the intervention for that length of time.

Finally, the absence of students' views is another limitation of this research. Students' views were not obtained for two reasons. Firstly, a number of the students in this study had speech and language difficulties, which would have limited the extent to which they could express their views. Furthermore, there was limited scope within this study due to time restrictions in carrying out the research. Considering these two points, it was decided that interviewing staff would have provided richer data regarding the use of IVM, compared to student interviews. However, it must be noted that the omission of students' views is a limitation of this study, and future research should seek to gain the views of students using IVM, especially as staff reported that some students appeared disengaged during the intervention.

6.5 Implications for practitioners

This research outlines that IVM is a potentially useful approach that can be used to teach life skills to individuals for whom these skills require explicit instruction. It draws upon evidence-based approaches such as PVM (Mason, 2013), systematic instruction, (Collins, 2012), VEs (Jenson and Konradsen, 2018; Kavanagh et al., 2017) and CTML (Mayer, 2009), enhancing its viability further. There is evidence to suggest that it is effective at teaching shoelace tying for some children. However, there is insufficient evidence to conclude that IVM is an effective intervention for a broad range of life skills. Further research is required that involves a wider range of life skills and a more diverse range of participants. Given the limited number of evidence-based approaches that aim to teach life skills to secondary and post-16 students (Mason, 2013), IVM outlines a potentially useful new avenue for intervention. In line with the findings of PVM literature, I recommend that staff who

wish to employ IVM consider using alongside approaches not used in this study, such as prompting, as this is likely to improve skill acquisition (Mason, 2013).

Furthermore, this study adds to the existing pool of literature that suggests that 360° video can be an effective teaching tool. Current research focuses on the application of 360° video in universities (Yoganathan et al., 2018; Harrington et al., 2018), this study extends this research by demonstrating the successful application of 360° video in a secondary special school. This new technology has a number of potential benefits for educators, such as providing participants with experiences that would not be otherwise available to them (Johnson, 2018). It is essential that education professionals use their expertise and knowledge to apply this technology in a way that draws upon recognised pedagogic practice (Johnston et al., 2018). This paper demonstrates one application of this technology. However, there are a multitude of other ways in which 360° video could be applied in the future that aligns with other pedagogies. The scope for applying 360° video in education appears to be broad, and I would therefore encourage education professionals to be adventurous in their application of 360° video whilst always being considerate of evidence-based approaches and pedagogy. Furthermore, there are very few published examples of 360° video being applied within education, despite the increasing use of VR in educational contexts (Johnson 2018; Kavanagh et al., 2016; Yoganathan et al., 2018; Harrington et al., 2018). Therefore, it is essential that practitioners who use VR based approaches, including 360° video, evaluate their work and share this with colleagues in peer-reviewed journals.

The findings of this study have been shared with school staff, participants, parents and the Education Psychology Service through the production of a brief research report (refer to appendix 22). It is hoped that sharing these findings allows

school staff, children, parents and other professionals to be able to make informed decisions regarding future uses of IVM.

6.6 Implications for Educational Psychologists (EPs)

EPs have been required to adjust their skill sets for working in post-16 settings (Atkinson, et al., 2015). However, there are limited evidence-based approaches that can be used in this area (Morris and Atkinson, 2018). IVM offers a potential avenue for supporting the development of life skills for individuals within this age group. This approach draws upon the evidence bases for PVM and VEs, which enhances its viability for professional practice. It also uses systematic instruction, which is an approach that many EPs are familiar with.

Additionally, the 360° video and HMDs offer EPs an opportunity to embrace new technologies and find evidence-based uses for them within educational settings. This study suggests that these technologies may have some therapeutic benefits, and the literature has provided significant evidence for the application. This includes the use of VR to reduce social anxiety (Powers and Emmelkamp, 2008), agoraphobia (Botella et al., 2007), and other phobias (Parsons and Rizzo, 2008) through the use of virtual reality exposure therapy. The accessibility and portability of VR equipment could allow EPs to create and deliver VR-based therapeutic approaches to support children and young people in a number of creative, ways such as providing a school refuser experience of being in a classroom (Gutiérrez-Maldonado, 2009), or supporting transitions to new settings. These are only two examples of how this technology could be applied, but I envisage that EPs and other professionals will be able to create innovative and effective uses for this technology in the future.

6.7 Critical Reflections

The use of systematic instruction resulted in children's progress being measured through observable behaviours. This offered the benefit of having an objective measurement tool that was highly relevant to the task being carried out and it was found to be very reliable (as found by the inter-rater reliability checks). Furthermore, two of the staff reported that they liked this approach to measuring progress. However, this approach's focus on observable behaviours is likely to have overlooked other psychological influences upon behaviour that could have provided greater insight into the findings obtained during this study. For example, the participants' motivation and attitude towards the task is likely to have had a significant impact upon the way in which they approached the task. This is best summarised by Scott's results. Scott's progress fluctuated throughout the intervention and his ability to complete the task seemed to reduce following session 10. This finding is not explained through the application of the paradigms employed in this study, such as systematic instruction and the hierarchy of learning (Haring and Eaton 1978). It is likely that psychological measures of attitude and motivation would have provided greater insight regarding factors that influenced Scott's performance and would have allowed hypothesis relating to his attitudes to be considered; such as learned helplessness. Consequently, future research should incorporate measures of attitude and motivation between sessions.

The qualitative phase of this study used a case study design and semi-structured interviews to collect data. This seemed like the most appropriate design prior to the start of data collection. However, the adult participants and school staff were incredibly welcoming and accommodating during the study. This meant that I was able to spend large amounts of time in the classroom over the course of the

intervention. I was also invited to spend time with the class when the intervention was not taking place to see other projects that they were working on. This was an unexpected privilege, and thoroughly enriched my understanding of the students and the staff's views. However, because of this, I had a number of conversations with staff and students over the course of my involvement that informed my understanding. These conversations were not formally recorded which meant that they were not included in data collection. Upon reflection I feel that an ethnographic approach to data collection would have provided a richer understanding of how the intervention was delivered by staff and how students responded to it. However, I was unable to predict that I would have been allowed such high levels of access to the classroom in which the study took place.

Furthermore, due to the knowledge of participants' views and attitudes I obtained during the intervention, I felt that the quality of the semi-structured interviews were negatively affected. Upon reflection, I feel that my prior knowledge of the participants' views meant that I lacked a natural curiosity that I often find enhances the quality of my questioning. When reading the interview transcripts I felt that there are times I could have prompted participants to provide more information. However, due to my prior understanding I did not use these prompts as I already knew the participants views. Upon reflection I feel that this affected the richness of the semi-structured interview data.

Additionally, the task that was selected in this study was cognitively demanding and complex as it is likely to have been challenging for the participants. Furthermore, it did not fully utilise the benefits of point of view modelling approaches, as they have been found to be most effective in supporting the understanding of visuo-spatial relationships (Mason, 2013). However, shoelace tying is predominantly

a motor skill. Consequently, shoelace tying was not best suited to being taught using IVM and it is possible that participants would have been more successful if another skill was selected. However, participants chose this skill and it was important that the research design was as participatory as possible. Additionally, children were very motivated to learn to tie their shoelaces and appeared very enthusiastic about this. Because of this, I decided to select shoelace tying as the skill, despite the fact that the skill was suboptimal for use with IVM. This demonstrates a tension between moral and practical considerations when carrying out research. In this instance making the most moral choice may have negatively affected the research project. Future research should take place in the community as this will allow participants to consider a wider range of skills and will allow researchers more scope to negotiate a more suitable skill.

This study aims to provide the foundation for future research into the use of IVM and VR. The present study has a number of limited factors that have been discussed throughout this thesis. Firstly, this study focuses on using observation of behaviour as its primary means of monitoring the intervention. Future research should consider how psychological factors influence participants performance in IVM, these factors should include motivation, attitude towards the learning task and intervention and the levels of presence. Furthermore, future research should gather the views of child participants and these views should be gathered through formal data collection measures. Additionally, other approaches should be incorporated within the current intervention to determine how they impact on the efficacy of IVM. These approaches should include, but are not limited to, backwards chaining and prompting.

6.8 Concluding Comments

The use of VR is expected to become more common within education over the next decade. However there is limited research investigating their application (see Chapter 1). Despite this, they appear to offer a number of unique benefits that are yet to be fully understood or embraced by educators. Consequently, it is essential that education professionals, including EPs, seek to develop evidence-based uses for these technologies. This thesis outlines the methods used to carry out IVM and offers quantitative and qualitative evidence to demonstrate its efficacy and viability with an educational setting (as discussed in Chapters 4 and 5). It was hypothesised that IVM would lead to the acquisition, maintenance and generalisation of shoelace tying when used with children in a specialist secondary school. This study found that only one participant was able to acquire, maintain and generalise these skills. Consequently, this hypothesis was not confirmed, although there is some evidence to indicate IVM can result in improvements in these areas. The qualitative phase of this study aimed to explore the experiences of individuals delivering IVM interventions and determine what they perceive the benefits and limitations of the intervention to be. Answers to these questions are discussed in section 4.4 of this thesis.

IVM is an early attempt at applying 360° video and VR technologies in an evidence-based, accessible, and easily replicable way. The use of handheld 360° cameras and mobile phone-based HMDs within IVM reduces the start-up costs and specialist training that have previously served as a barrier to educators adopting these technologies. I hope that this thesis demonstrates how evidence-based practices can be enhanced through the use of VR and inspires education

professionals to incorporate VR-based approaches within their practice, including IVM.

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Appendix 1- Studies table

Study	Setting	Skills taught	Participants	Display method	Research design	Measures used	Findings
Johnson (2018)	University Religious Education Class	knowledge, empathy and critical reflection of religious experiences	38 university students in the US	HMD and mobile devices (both 360 video)	Evaluation	Student survey and authors reflections	The results showed that students felt that they had a better understanding of religious practices and increased empathy which made some feel closer to religion. Feedback was positive 7.9 out of 10. The author felt that the use of VR was valuable but pointed out some practical limitations including negative side effects and cost.
Herault Linckea, Forsgärdeb and Elmqvist. (2018)	University Nursing Study	Experience of trauma treatment in a hospital	17 specialist nursing students aged 24 to 45 in Sweden	Computer monitor (360 video)	Evaluation	Observation of recorded sessions and student questionnaire	94% of students appreciated the use of 360 videos, although 65% of participants had some issues with the touchscreen. The use of the 360 video was conducive to

							collaborative discussion based learning.
Rupp et al. (2016)	University	Knowledge of the International Space Station (ISS)	63 university students aged 18-30 in the US	Mobile phone screen, google cardboard and Oculus Rift (all 360 video)	Experimental design to compare the methods of presenting the video	Measures: -Knowledge of ISS (pre and post video) -Levels of presence -Levels of sickness -Attitude towards VR	This study found: -No significant differences in levels of sickness. -There was a moderate effect of device and presence -There was a moderate negative effect of between presence and recall of auditory information -Overall there was no significant difference of recall between conditions
Yoganathan, Finch, Parkin and Pollard, 2018	Doctor training in University	Tying a reef knot	40 first year post graduate Doctor students in the UK	HMD (360 video) vs laptop screen (2D video)	Experimental (RCT)	Knot tying skill as measured by a observation schedule	There was a significant difference in knot tying scores between the groups. 360 video increases performance accuracy but not speed.

Harrington et al. 2018	Medical training in University	Experience of operative procedures	40 undergraduate medical students in Ireland	75 inch screen (2D video) vs HMD (360 video)	Experimental	-Retention quiz -Levels of engagement -Non-task related thoughts -	There were no significant differences in retention but levels of engagement and non-task related thoughts were significantly better in the 360 video condition.

Appendix 2- A summary of the key features of single case experimental design (based upon Horner et al., 2005).

Critical features of Single Case Experimental Design	How they were applied in this study
Participants/ Setting	• SCED normally has a small number of participants, This study had 5 participants. • Each participant acted as their own baseline. • Participants and the setting of the study are described in sufficient detail to allow the study to be replicated
Dependent Variable	• Dependent variables are be operationally defined to allow valid and consistent assessment of the variable and replication of the process. • Dependent variables are measured repeatedly within phases to allow identification of performance and comparison of performance between phases. • Validity and reliability checks are in place to ensure that the dependent variable is measured consistently throughout the study (see section 3.6)
Independent Variables	• The independent variable is operationally defined to allow replication. • The independent variable is actively manipulated and withheld during the baseline phase and withdrawn following the intervention phase. • The independent variable is administered consistently and there is fidelity in how this is done (see section 3.6 for fidelity checks)
Baseline/ Comparison Condition	• The dependent variables are be measured without the independent variable being present on three occasions so that there is a stable measure of responding.
Experimental Control	• The experimental effect is observed at three different points in time.
Social Validity	• The dependent variables have high importance as determined by participants. • The procedures were discussed with staff and were found to be acceptable for use and feasible for us in the environment in which the intervention is being proposed.

Appendix 3**- Task analysis/ observation checklist**

Tying shoelaces				
Stage	**Step**	**Success Criteria**	**Shoe 1**	**Shoe 2**
Knot 1	1	Cross laces		
	2	'Loop de loop' to make a reef knot		
	3	Pull the knot tight		
Knot 2	4	Cross the laces again		
	5	'Loop de loop' to make a reef knot		
	6	Pull the knot so there is enough room to post the ends of the laces through		
Loops	7	Post the end of the first lace through the hole		
	8	Post the end of the second lace through the hole		
	9	Pull both bunny ears tight		
Quality control	10	The shoe should be correctly tied		

Appendix 4- Project introduction sheet for staff

Immersive Video Modelling Research Project

What is Immersive Video Modelling?

Immersive Video Modelling (IVM) is a new intervention that involves exposing children to 360' videos that show a social/functional skill being carried out from a first person perspective. The video will be recorded using a 360' camera, the participant is then shown the video using a virtual reality headset Through exposing the individual to the video over a number of sessions it is anticipated that they will be able to acquire the skills in the video. This could include a number of skills such as getting on a bus, buying an item in a shop/canteen or travelling to a new location.

Is there evidence to suggest that IVM works?

The use of virtual reality to teach skills is a relatively new concept and there is some evidence to suggest that it is effective, however similar studies have used virtual reality environments (i.e. rooms with projections onto walls). A study of this using VR headsets in this way has not been carried out before. However, there is good evidence to show that showing children videos of individuals carrying out skills leads to the acquisition of this skill. The findings of these studies have been synthesised to ensure that this approach uses the things that we have learnt from previous research has been included.

What are the aims of this project?

The project is broken down into two parts. The experimental phase and the evaluative phase. The experimental phase involves using the VR headset to teach the skills and it aims to answer the following questions:

4) Does IVM lead to skill acquisition?
5) Does IVM lead to skill generalisation? i.e. using the skill in other contexts.
6) Does IVM result in skill maintained? i.e. being able to use the skill after a period of time without practicing it.
7) Does the use of IVM lead to participants feeling more confident in carrying out the skill.

The second part of the project is the evaluation phase. In this phase individuals who implements/ oversaw the intervention will be interviewed to find out about their experiences of administering the intervention.

Who will take part in this study?

Participants will fall into two groups: child participant and adult participants. Child participants will be selected for the experimental phase of the study. Ideally between 3 and 5 participants will be selected for the experimental phase to be eligible for the study students will need to meet the following criteria:

- The must be able to attend to a stimuli for 3 minutes- this will be measured by exposing the individual to an interesting video for 3 minutes
- All participants must feel comfortable wearing a virtual reality headset, they must not have a history of epilepsy of severe motion sickness. They must be over 13 years old.
- They must all be able to imitate another person completing an activity.

Consent will sought from the parents/guardians of participants.

Adult participants will be staff employed by the setting in which the study is carried out. These participants will be given full training in how to deliver the intervention. They will also deliver the intervention although they will receive high levels of support from the research to ensure that the intervention is delivered as intended.

What will the study involve?

Experimental phase of the study will have four parts these are as follows:

Duration	Phase	Description
2-3 sessions	**Baseline**	Participants will be placed in an environment in which they are expected to carry out the target skill. They will be given a short instruction to carry out the target skill e.g. “buy a chocolate bar”. The progress will then be recorded using an observation checklist. Non-descriptive verbal praise will be used if the participant completes an item on the checklist for example “well done”. This phase will take place three times to ensure that the baseline result is an accurate reflection of the participants ability.
Up to 15 sessions carried out over three weeks	IMV	During this condition participants will have access to an instructional session where they will be presented with the immersive video model. The video will be recorded using a 360’ degree camera held at the participants eye level. The target skill will recorded from a first person perspective. The researcher will serve as the model in the videos, although their face will not be in the videos, participants will be able to see the researchers hands interacting with the environment. Participants will watch the videos through a virtual reality headset with blank password protected phone serving as the screen. The intervention be delivered daily. They will then be immediately followed by an assessment session in which the participant will be asked to carry out the target skill. Participants will watch the video twice and the video will contain narration. The video will also be

		projected onto a screen so the facilitator can ensure that the participant is attending to the correct part of the video. The assessment of this phase will follow the same procedure as the baseline phase and will continue until the participant reaches the success criterion (80% success rate over 3 sessions) The participant will be assessed daily following the intervention. The intervention will be discontinued if the participant fails to make progress over 5 consecutive sessions or if the intervention exceeds 15 sessions. During this phase 20% of sessions will be recorded by the researcher.
1 session	Generalisation	Generalisation of the skills taught during the intervention will be measured once after the participant archives the mastery criterion. Participants will be asked to carry out the skills in a different setting and/or with a different person. The same behavioural checklist will be used to measure if the participant is able to successfully generalise these skills. If a participant meets the discontinue criteria they will not go forward to this part of the study.
1 session (around three weeks after the last IMV session)	Maintenance	The maintenance phase will follow the same procedure as the baseline phase. It will take place three weeks after the final intervention session to measure if the participant has retained the skills they acquired during the intervention. If a participant meets the discontinue criteria they will not go forward to this part of the study.

Ethical considerations

The University of Birmingham ethics panel has fully reviewed and approved the research project. Ethical considerations include protection from harm, right to withdraw and informed consent. Data will be handled in line with the University of Birmingham guidelines, GDPR and the data protection plan created for this project.

Are there any potential risks to students?

There is a small chance that participants may experience some adverse side effects as a result of using the virtual reality headset. Information from the manufacturer states that 1 in 4000 users can experience the following severe side effects: severe dizziness, seizures, epileptic seizures or blackouts triggered by light flashes or patterns. To reduce the likelihood of this risk individuals who have a history of seizures or epilepsy will not be asked to participate in the study. It is also possible that participants may experience the following less severe side effects: loss of awareness, eye strain, eye or muscle twitching, involuntary movements, altered, blurred, or double vision or other visual abnormalities, dizziness, disorientation, impaired balance, impaired hand-eye coordination, excessive sweating, increased salivation, nausea, lightheadedness, discomfort or pain in the head or eyes, drowsiness, fatigue, or any symptoms similar to motion sickness. Participants who experience these symptoms will be withdrawn from this study.

What are the next steps?

Date	What's involved
Before Christmas break	• Get consent from parents • Introduce the idea to the staff involved and gain consent • Introduce the idea to the students • Get consent from students • Carry our pre-requisite assessment • Decide on the tasks and prepare the videos and equipment
January- February 2019 (before February half term)	• Introduce the idea to staff supporting the sessions • Record some of the sessions to assess fidelity and ecological validity • Do the initial baseline sessions • Carry out the intervention sessions for up to 3 weeks (15 sessions)
After February half term	• Carry out the maintenance and generalisation sessions. • Interview staff

Appendix 5- Parent's invite

Dan Hawkins

Trainee Educational Psychologist

Email: [redacted]

Dear year 9 parents,

I am Trainee Educational Psychologist currently working in [redacted] As part of my doctoral study I am completing a research project into a new way of teaching independence skills to young people. My project involves presenting a child with a virtual reality video of somebody carrying out a skill. It is hoped that from watching this video the child will be able to learn this skill and use it in their everyday lives.

I would like to invite your child to participate in my project. To help you to make an informed decision as to whether you would like your child to participate, I would like to invite you and your child to an information session in which I will demonstrate what the research involves. I will also explain all of the ethical considerations that have been made to protect your child during this research. The date of the information session is:

4:15pm- Monday 17th December at [redacted] High School

If you are interested in your child participating this research but you cannot attend the information session I can send you an information pack and/or provide you with information via the telephone at a time that is more convenient for you.

I would be grateful if you could complete the response for below and return it to Mrs Gregory.

Yours Sincerely

[redacted]

Dan Hawkins

Response slip

Your child's name: _____

(please tick)

I would like to find out more about this research and I would like to attend the information session

I can't attend the information session but I would like more information about the project

I don't want my child to participate in this research

Appendix 6- Children's invite

Dear 9B,

I would like to find out if young people can learn things from watching virtual reality video's.

To test this, I would like to show you a video of a skill you would like to learn. This could be:

Making something to eat

getting dinner/ a snack

finding something on the computer

But there may be something else you would like to learn.

We would then practice the skill together in school.

I would like to come to school to talk to you about this. Before I come to see you can you think about what you might like to learn?

It is okay if you do not want to help me with this.

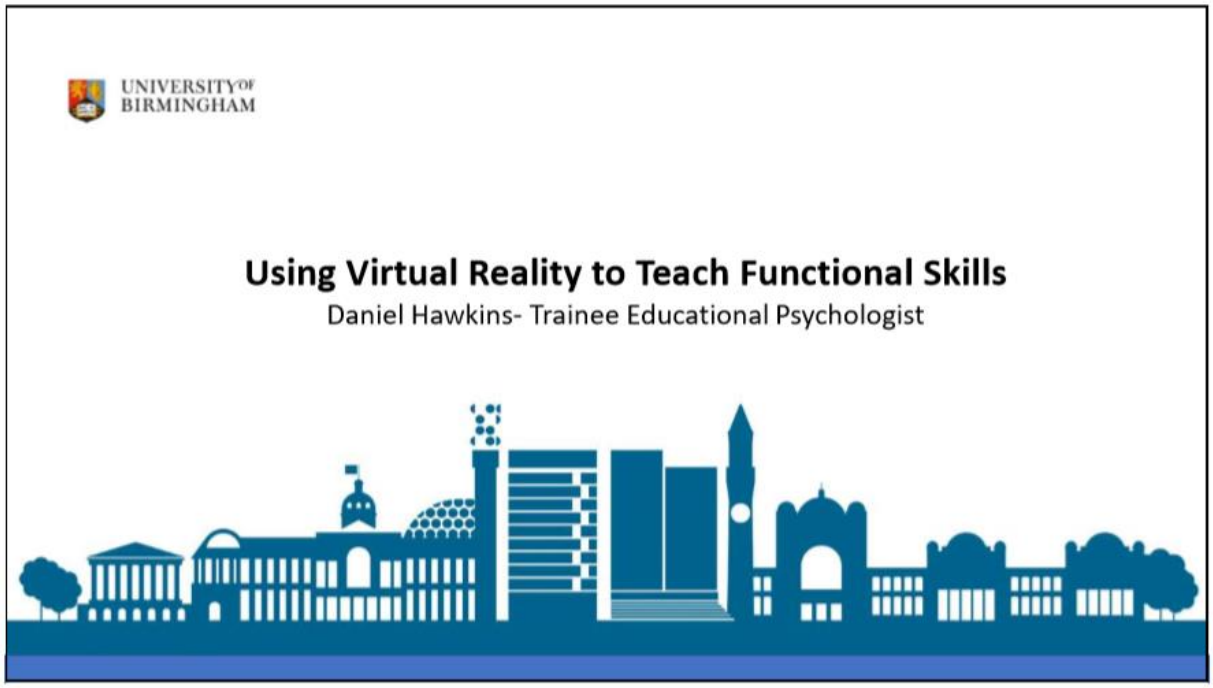
Many thanks,

Dan Hawkins

Trainee Educational Psychologist

Appendix 7- Parents presentation

1



What is this research for?

This research is being carried out as part of my completion of the Applied Educational and Child Psychology Doctorate.

It will be written up into a thesis and may also be published in a journal after it is completed.

3

Aims

- Find out what VR modelling is
- Find out what my research involves
- Give you the opportunity to ask questions
- Decide if you would be happy to take part

4

What is Immersive Video Modelling?

5

What skills can you learn using Video Modelling?

6

See how it works

7

Will it work?

- There is good evidence to show that children learn skills from videos.
- There is some evidence to show that children can learn skills from a 1st person perspective
- There is currently no research that presents videos using VR.

8

What will the study involve?

- Children decide on a skill they want to learn.
- They are shown a video every day before being asked to complete the skill.
- The child keeps practicing everyday until they learn the skill.
- If the intervention isn't working it will stop after 5 days.
- After the intervention has finished the we will practice the skill again in a new place or in a slightly different way to see if the skill can be generalised. I will also check that the child can perform the skill 2 weeks later to make sure the learning is maintained.

9

Are there any potential risks involved?

- A risk assessment has been carried out to make sure that it is very unlikely participants are harmed in the study. However the VR headset has some potential negative side effects:
  - Children under 13 should not use them
  - Individuals who have a history of seizures should not use them
  - In some cases, the headset can cause motion sickness

10

Children who can't/ don't want to use the headset can still take part

11

Recording

- As part of the study children will be recorded carrying out the skill. This is so:
  - I can make sure that the intervention is being delivered the same way all of the time.
  - The skills are being carried out correctly.

- Video will be kept securely in line with data protections (GDPR). Only the researcher and their supervisor will see the video.

12

Other Important Things

- You do not have to take part if you don't want to.
- You can withdraw from the research at any time until 2 months after the study has finished.
- All of your information will be anonymised in the write up of the research. It will not include any identifiable information.

13

Next steps

- Decide if you would like to take part
- Complete the consent form
- Think about the skill you would like to learn
- I'll visit the school in January to begin the research and spend some more time with the class

14

Thank you for your time

Any questions?

15

Appendix 8- Parent consent form

Consent Form

In order for your child to to participate in the study you must first provide written consent to do so. Please read the following information and sign the bottom of the form if you understand and agree to the points outlined below. If you have any questions regarding any of the points please do not hesitate to ask the researcher.

I sign to agree that:

- The researcher has explained the research project to me as well as my child's role in the project.
- I have been informed that I can withdraw my child from the study at any time up to 2 weeks after the trip.
- I am aware that my child's identity will be protected throughout the study. Their name or identifying information will not be used in any research reports.
- I give consent for the results of my child's involvement in this study to be used in the researchers thesis and any subsequent publications.
- My child does not have a history of seizures (this only applies if you would like your child to wear the headset)
- I have read the cover letter and FAQ and I understand that there is a small chance that my child may experience some negative side effects from using the headset.

Please tick your response below:

☐ I would like my child to take part and watch in the IMV intervention.

☐ I would like my child to be able to learn a new skill but I do not wish for them to wear the headset.

☐ I do not want my child to take part in this research.

Signed: ……..

Name: ……..

Date: ……..

Appendix 9- Child consent form

Child consent form

(This form is to be completed by the researcher)

The researcher has endeavoured to explain the following to the young person:

	(tick if this has been explained to the child)
• That they are taking part in a study as part of the researchers training	☐
• This involves them watching a video to teach them how to perform a skill (the skill will be specified)	☐
• This video will be played through a VR headset (they have been shown the headset)	☐
• They will be asked to practise the skill (the practise location will be specified)	☐
• They will watch the video and practise the skill every school day for up to 20 days	☐
• As part of the experiment in they will be recorded	☐
• They don't have to take part if they don't want to	☐
• The researcher will keep their information confidential (only their school and their family will know that they have taken part in the study)	☐
• If they change their mind they can withdraw from the study at any time	☐

Describe of this information has been explained to the child. Describe specialist approaches employed:

_____
_____
_____

Signed: _____ (researcher)

Date: _____

Appendix 10- Adult participant information script

Adult Participant Information Script

This script will be delivered orally by the researcher, the points will be explained:

- The nature of the intervention
    - Participants will be trained to oversee the video modelling intervention
    - An explanation of the intervention procedure
    - The aims of the intervention
- The participant's involvement in the research
    - Information about when the interview will take place and what the purpose of the interview is and it's duration
    - The interview will be recorded, data will be anonymised in the transcription process. Recordings will be kept secure for 10 years before being destroyed. Only the researcher will have access to the recordings
- The participants rights throughout the study:
    - Right to withdraw from the study at any time up to 2 months after the intervention
    - All data will be anonymous although broad details about the school may be included (for example, the type of school and what region it is in).
    - Anonymised extracts from the interviews may be used in the final research report and any subsequent publications.
- Do you have any questions?

Appendix 11- adult consent form

Consent Form (adult participants)

In order for to participate in the study you must first provide written consent to do so. Please read the following information and sign the bottom of the form if you understand and agree to the points outlined below. If you have any questions regarding any of the points please do not hesitate to ask the researcher.

Research project title: **"Immersive video modelling: evaluating the application of using a video modelling intervention to teach functional skills in a specialist secondary setting"**

I sign to agree that:

- The researcher has explained the research project to me as well as my role in the project.
- I have been informed that I can withdraw from the study at any time. I have also been informed that I can withdraw any of my comments from the study at any time.
- I understand that I can refuse to answer any question without being pressured or questioned by the researcher.
- I am aware that the interview will be recorded using audio capture equipment. This recording will only be heard by the researcher.
- I am aware that my identity will be protected throughout the study. I will remain anonymous at all times.
- I give consent for extracts from my interview to be used in the research project.

Signed: ……..

Name: ……..

Date: …….

Appendix 12- Staff training materials (procedure)

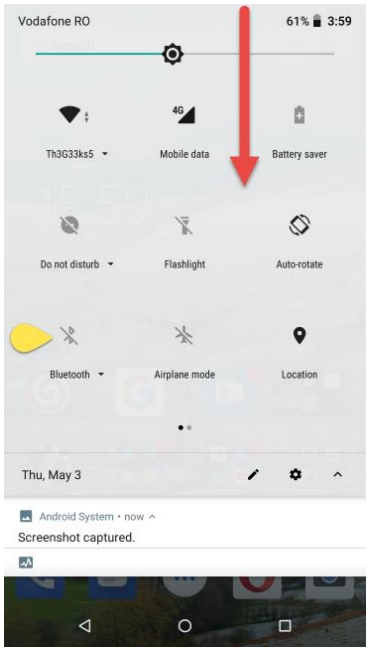
Procedure

Setting up the Equipment

Phone

1. **Turn the phone** on using the button on the right hand side of the handset- charge it if necessary an hours usage will likely use a whole charge.
2. **Turn on the Bluetooth**

a. Swipe down from the top of the screen *twice* to pull down the menu. Look for the Bluetooth logo (The logo next to the yellow tab in the image below.)



b. If the logo is grey press it so it turns blue. If it is already blue ignore this step
c. Tap the screen beneath the logo where it says 'Bluetooth'
d. Using the VR remote, press the big round button to turn the remote on
e. Using the phone press the item that says "Gear VR Controller" the phone should then connect to the controller/

3. **Set up the items** to carry out the skill (each skill has an equipment list)

When the child arrives

▶ Place the phone in the VR headset

- Put the headset on yourself (make sure you are seated and don't have anything near to you that can be knocked over)
- Adjust the headset into focus
- Face the same direction as the child
- Pick up the remote
- Hold the home button on the remote (concave button in the middle)
- The home screen will then appear
- Select the Samsung Gallery by pointing the remote and pressing the middle button.
- Select the "album" option.
- When in the gallery choose the 360 video option on the left panel
- Select the video that matches the skill you are teaching
- Use the remote the play the video (point it at the play button in the middle of the screen)
- Once the video starts to play swipe left on the middle button to rewind/pause the video- keep your finger on the pad to prevent it from playing
- Take the headset off
- Ask the child to put the goggles over their eyes
- Ask them to hold the goggles with one hand, and pull the strap over their head with the other
- Make sure that the Headset is comfortable
- Adjust the focus until the can see clearly (ask them if it is better or worse)
- When you are ready to start the video let go of the remote- or, if you have already let go and the video is still playing, swipe left a few times until the video re-starts.

After the video

- Once the video has finished ask the child how they feel. To make sure that they don't feel nauseous
- Monitor how they stand up from their seat.
- Ask them to carry out their skill and record the progress.

Trouble shooting

The screen is blank or says that the phone is too hot

The phone can become hot when it has been using VR for too long. If this happens you can take the phone out of the headset too cool down. To prevent this from happening you should take the phone out of the headset while it is not in use

The child doesn't like using the headset or feels nauseous/dizzy.

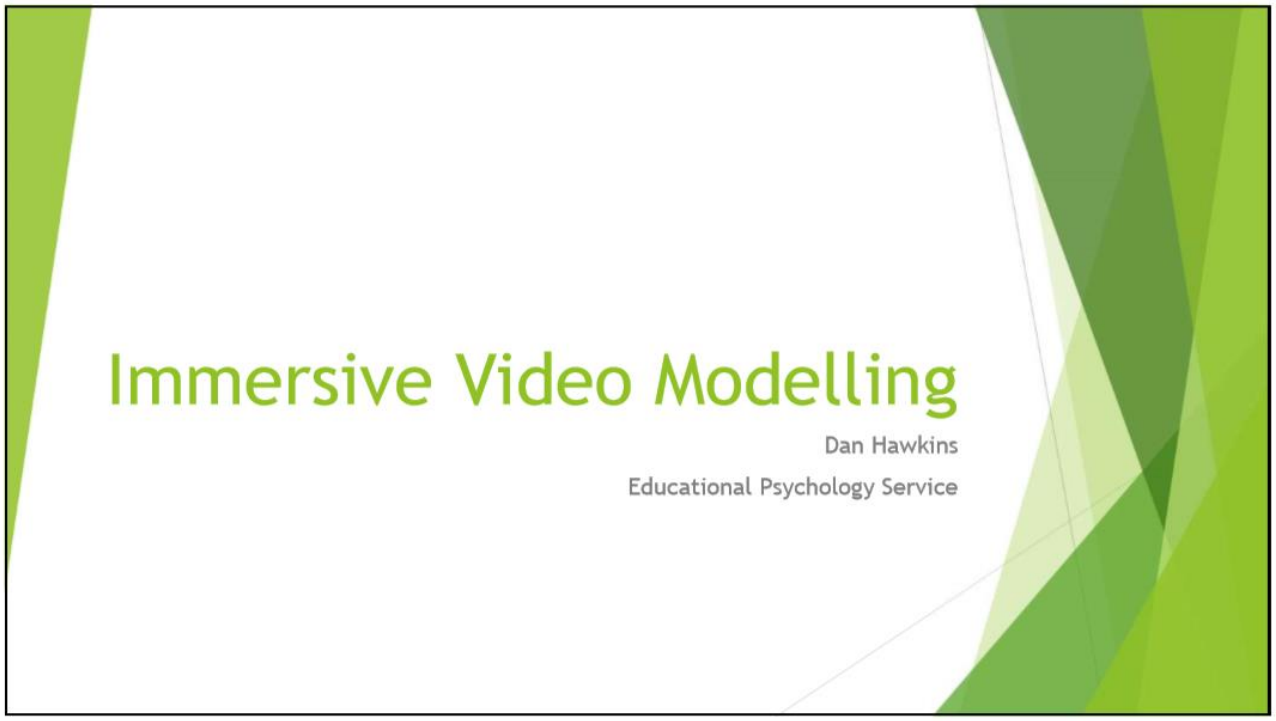
If a child reports nausea, dizziness, headaches or blurred vision remove the headset and do not ask them to use the headset again that day. If the child wishes to try to use the headset again you can give them another chance at your discretion, however it is important to monitor how they feel throughout.

It may help the child to change the view. You can do this by selecting the left hand option that appears while the video is playing. The 180' option zooms the camera out and is more stable.

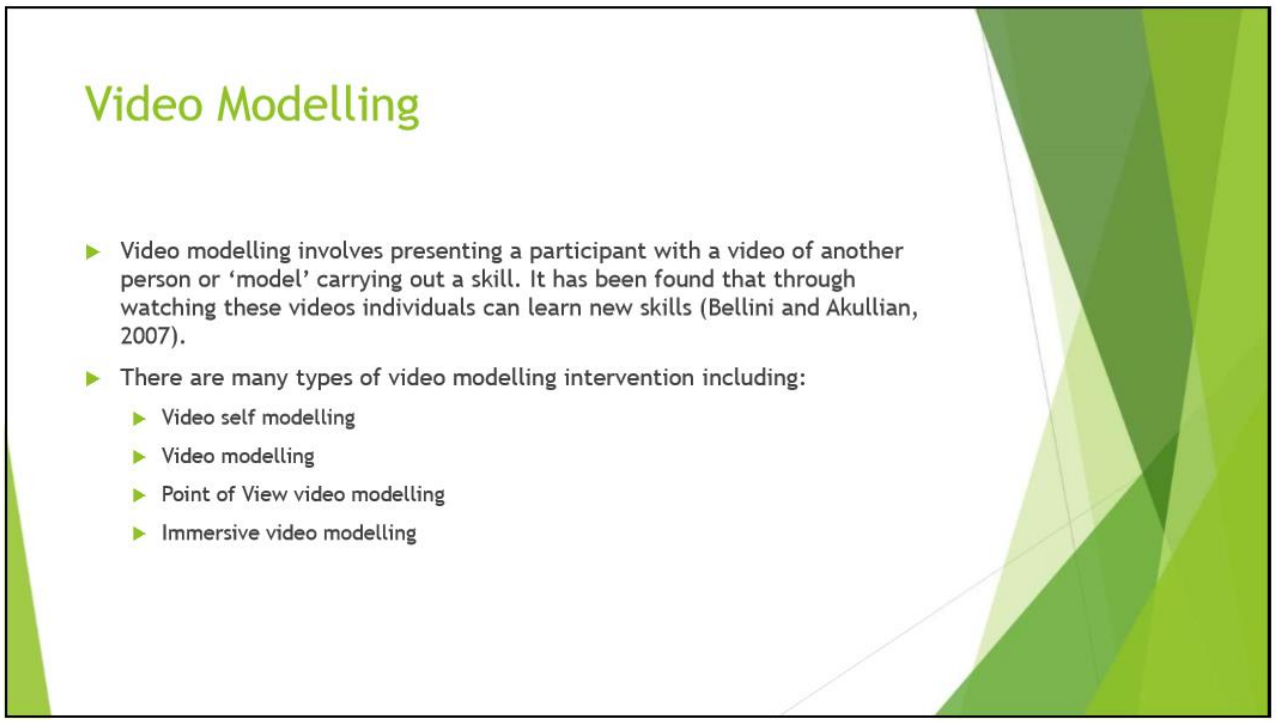
The phone won't connect the remote

If this happens check that you have pressed the middle button on the remote to activate it. If it persists you may need to change the batteries in the remote.

Appendix 13- Staff training session slides



1



2

What is Immersive Video Modelling?

- Participants are shown a video of a person carrying out a skill
- Videos are shot from a first person perspective
- Videos are made using a 360' headset
- Videos are shown to participants through virtual reality headsets

- This is a new intervention and there is currently no evidence base to show that it is effective, although we know that similar approaches are effective.

3

How will the intervention work?

- The intervention will take place daily for up to two weeks (or 10 days)
- The immersive video will be watched twice per day- this will count as two sessions of Immersive Video Modelling.
- If they child masters the skill for three days in a row they have finished the intervention
- If children do not make progress for 5 days in a row they will be withdrawn from the study.
- The intervention is delivered one child at a time.
- If a child does master the skill I will return three weeks after the intervention to see if they have maintained it.

4

Procedure

5

Equipment

To carry out the intervention you will need:

VR goggles

A headset remote

A phone with the 360 videos stored on them

The equipment to perform the task

6

Session 1

I will be in school for session 1. This will involve:

Getting consent- Letting the child know what the research involves and informing them of their right withdraw

Obtaining a baseline- asking the child to complete the skill independently without the video

Confidence measure- Asking the child how confident they feel in carrying out the skill (this will be repeated at the end of the study)

Introducing the VR headset- Setting up the lenses, letting the child feel comfortable in the headset and making sure they are happy to proceed with the study

Practice the skill- this follows the procedure for a normal session.

7

Normal session structure

- Set up the equipment
- Child watches the video
- Child practices the skill (their progress is recorded)
- They watch the video again
- They practice the skill again (progress is recorded)

8

Setting up the equipment (before the child arrives)

Phone

- Turn the phone on- charge it if necessary an hours usage will likely use a whole charge.
- Turn on the Bluetooth (if it isn't already on)
- Using the Bluetooth, search for the Samsung remote and connect

Skill

- Set up the items to carry out the skill (each skill has an equipment list)

9

Setting up the equipment (when the child arrives)

- Place the phone in the headset
- Put the headset on yourself (make sure you are seated and don't have anything near to you that can be knocked over)
- Adjust the headset into focus
- Face the same direction as the child
- Pick up the remote
- Hold the home button on the remote (concave button in the middle)
- The home screen will then appear
- Select the Samsung Gallery by pointing the remote and pressing the middle button in.
- Select the video that matches the skill you are teaching
- Use the remote the play the video (point it at the play button)
- Once the video starts to play swipe left on the middle button to rewind/pause the video- keep your finger on the pad to prevent it from playing
- Take the headset off

10

Setting up the equipment (Teaching the skill)

- Ask the child to put the goggles over their eyes
- Ask them to hold the goggles with one hand, and pull the strap over their head with the other
- Make sure that the Headset is comfortable
- Adjust the focus until the can see clearly (ask them if it is better or worse)
- When you are ready to start the video let go of the remote- or, if you have already let go and the video is still playing, swipe left a few times until the video re-starts.

11

Recording a child's progress

- A record sheet has been prepared for each skill
- As the child performs the skill you can tick off the record sheet
- The child doesn't need to complete the skills in order as long as you feel that it is still a correct way of carrying out the skill. For example, it's okay to put the sugar in before the milk but it's not okay to take out the teabag before you put the water in the cup.
- Once the child has completed the skill tally up the ticks to see how well they have done. Please record this total on the record sheet.

12

Health and Safety

- When using the headset it is important that the following safety precautions are observed:
  - Take off glasses before wearing the headset
  - Put the goggles over your eyes before you put the strap on
  - Remain seated while wearing the headset
  - Ensure that there are no items that can be knocked over nearby
  - If a child reports nausea, dizziness, headaches or blurred vision remove the headset and do not ask them to use the headset again that day.
  - If the child wishes to try to use the headset again you can give them another chance at your discretion, however it is important to monitor how they feel throughout.
  - There is a small chance that the headset can cause seizures. Children who have a history of seizures should not wear the headset.
- Any activities that use hazardous substances (i.e. hot water) should be closely supervised by an adult.

13

Providing feedback

- Because this is a research project there are certain restrictions on providing feedback.
- Verbal feedback can be provided if the child performs a step correctly (e.g. good, well done).
- Verbal feedback should not be given if the child does something incorrectly. The only time you would intervene is if the child is doing something unsafe.
- After the session you can discuss the area the child made a mistake buy you should not tell them what they should have done instead.
- At no point should you demonstrate to the child what they should have done instead.

14

Ending the intervention

- The intervention will end if a child is able to carry out the skill to the mastery level (80% correct) on three consecutive days.
- If a child does not show any progress across 6 consecutive sessions they should be withdrawn from the intervention- although you may wish to try other approaches to teach the skill (we can discuss this if it happens).
- If a child's lack of progress could be due to absence or medical reasons they can remain in the study although their progress should be monitored

15

Appendix 14- Implementation fidelity check

Step no.	Step	Completed (tick if observed)
1	Shoes are set up in front of the child	
2	Place the phone in the VR headset	
3	Put the headset on yourself (make sure you are seated and don't have anything near to you that can be knocked over)	
4	Adjust the headset into focus	
5	Pick up the remote	
6	Face the same direction as the child	
7	Hold the home button on the remote (concave button in the middle)	
8	Set up the video. Once the video starts to play swipe left on the middle button to rewind/pause the video- keep your finger on the pad to prevent it from playing	
9	Take the headset off and ask the child to put the goggles over their eyes	
10	Ask them to hold the goggles with one hand, and pull the strap over their head with the other	
11	Make sure that the child is comfortable	
12	Adjust the focus until the can see clearly (ask them if it is better or worse)	
13	Start the video	
14	Once the video has finished ask the child how they feel. To make sure that they don't feel nauseous or dizzy	
15	Ask them to carry out their skill and record the progress.	

Appendix 15- Creation of interview questions

Finding from experimental phase	How this influenced the research question
Not all participants demonstrated progress within the observation schedule.	More information is required about what progress participants made and why some participants didn't make progress. This influenced questions: Q1) How do you think the children/ young people found the intervention? Q4) Was there anything that you liked about the intervention? Q5) Was there anything you didn't like about the intervention? Q6) Do you think that you would use this intervention again? Why?
One participant was able to generalize the skills they mastered during the intervention .	The extent of generalization and maintenance of skills needs to be triangulated using qualitative measures. "Therefore the sub-question: Were they able to use that skill in other environments" was included.
High levels of intervention fidelity were observed.	This suggests that the intervention was easy to administer, however this should be triangulated though qualitative data using the question: How did you find delivering the intervention?
There was little information regarding staff experience and opinions of the intervention from the quantitative data.	To find out more about staff experience of the intervention the following questions were included: Q4) Was there anything that you liked about the intervention? Q5) Was there anything you didn't like about the intervention?
Anecdotal reports during the intervention indicated that children became more confident during the intervention .	To investigate this the following question was included: Q3) Did you notice any of the young people become more confident when performing the target skill as the intervention went on?
Staff adjusted the intervention following the quantitative phase based upon their experiences.	To investigate alternative uses of the approach the following interview question was included: Q6)Do you think that you would use this intervention again? Why?

Appendix 16- Interview Schedule

Interview schedule

Thank you for agreeing to take part in this interview. I would like to find your views about the immersive video modelling intervention you delivered. I'm going to ask you a number of questions. You don't not have to answer every question. If I ask you a question you don't wish to answer or not sure of how to answer please feel welcome to pass that item. This interview will last for approximately 30 minutes. please let the researcher know if you wish to end the interview before then.

Q1) How do you think the children/ young people found the intervention?

- Did they make progress? Did they learn the intended skill?
- Were they able to use that skill in other environments
- Did they seem to enjoy or dislike the intervention?

Q2) How did you find delivering the intervention?

- Was it easy to understand and deliver?
- Was there anything about delivering the intervention you found challenging?
- Was there anything that made the intervention easier to deliver?
- Was there anything that could of improved your delivery of the intervention?

Q3) Did you notice any of the young people become more confident when performing the target skill as the intervention went on?

- If yes- why do you think they became confident? (Because they knew what to do? Because they knew the environment from the headset? Because they had spent more time in the environment?
- If no- why not? (where they confident already? Did they become more anxious? Did their anxiety levels stay the same?)

Q4) Was there anything that you liked about the intervention?

- E.g. anything you enjoyed while delivering it? The use of technology? Being able to work with the children 1:1? Being able to take the child into environment they can use a skill in? the progress the chid made?

Q5) Was there anything you didn't like about the intervention?

- E.g. The use of technology? Being able to work with the children 1:1? Being able to take the child into environment they can use a skill in? the progress the chid made?

Q6) Do you think that you would use this intervention again? Why?

- If no- are do you feel that there are better ways of teaching children functional skills?
- If yes, how would you use this intervention again in the future?

Appendix 17- Interview transcripts

Interview transcript: Participant 1

I : So how do you think the young people found the intervention then?

Participant 1: I think they found it quite exciting

I: Yeah

Participant 1: They err no I don't think they've come across anything like that sort of thing so I think it was quite exciting for them.

I: Yeah

Participant 1: -I think some of them struggled at the beginning like, getting to like, because it was quite distracting in the room I suppose because there was other people like in the video sort of thing but once they got used to that they had to look at the shoes or the cup of tea (laughs) they got it.

I: So you got good levels of focus from them quite quickly.

Participant 1: Yeah, yeah, quite quickly, they picked it up quite quickly so….

I: That's good how many sessions do you think it took for them to kind of focus…..

Participant 1: Emm, probably about two maybe, a bit more with some of the others but most of them it was about two.

I: Good okay and did they make progress from just watching the video?

Participant 1: Emm yes, some did Emm and then others it was maybe like taking a step back sort of thing instead of watching the video and doing the skill breaking it down step by step to the same bits, to the same steps that were in the video but sort of modelling it to them.

I: Yep

Participant 1: But then the video also helped because they could see what was happening sort of thing too but emm sort of taking that and unwind.. unpicking it sort of thing.

I: So you think having the video along side you doing it

Participant 1: Yeah modelling helps quite a bit

I: Yeah okay. And is there anything that they seemed to dislike about the intervention?

Participant 1: Emm sometimes they like… one student in particular it was the

concentrate…. like if you had to do two sessions at a time he struggled with doing the two sessions.

I: Yeah

Participant 1: Or like if the video was quite long it was that time, of like focusing on the video that's why like he worked better with the modelling because

I: Yeah

Participant 1: It was like I do this now you do this for me sort of thing.

I: Yeah that makes sense. That makes a lot of sense actually. Emm and of the children who did learn it, have you seen them use that in other settings as well, so not just in the intervention in other…

Participant 1: Yeah so emm we do forest schools where they have walking boots sometimes so a lot of the children have been tying up their own trainers or walking boots in that and before PE they have been transferring the skill there and if they have ever worn trainers of their own to school they have transferred the skill to that which is good because then obviously it obviously hasn't got the coloured laces and they have transferred the skill to that without the coloured laces, they are learning how to do it without just coloured laces.

I: Yeah so they can make that step as well, that's good.

Participant 1: Yeah yeah

I: And in terms of you delivering the intervention then. How did you find delivering the intervention? Was it straight forward to understand, was it easy to understand first of all.

Participant 1: Emm it was, yeah it was easy to understand. It's just the whole set up of it obviously but the emm, the recording of it, because it was split into steps, it was quite easy to follow so….

I: Yeah so is there anything that's part of the intervention that you think is, that you think was more challenging to deliver so …

Participant 1: Emm

I: Was the video okay to set up and administer….

Participant 1: Err yeah, no I found it quite easy to administer sort of thing…yeah I found it was probably the just double checking it… that it was all alright after

watching it sort of thing and what I did find tricky was you saying, asking if they can see whether they've cleared it but obviously you will never know whether it was clear to them..

I: Yeah that is a good point

Participant 1: Sort of thing I'd never know whether it was or it wasn't or they were just saying it to make me happy (laughs)

I: Yeah, that's a really good point actually. I noticed that some of them were saying yes no matter what you said

Participant 1: Yeah that's it and you are like are you sure?

I: Yes that's a really good point. Was there anything that made it easier to deliver… was there anything that made it easy to understand?

Participant 1: Probably the way… like how you have to tick off the skill, like step by step emm and how it was worded and also I like the fact that emm they watch it through the video and how you can set it up through like the remote sort of thing but the only thing that I used forget that you had to face the same way didn't you

I: Yeah

Participant 1: So you had to make sure you were facing the same way you and make sure you always had it in that in that section but no I think to be fair I think it was quite easy to set up yeah.

I: Is there anything that you think could be better about delivering it?

Participant 1: Emm I think the first method was emm good for some of the children and then maybe it was a bit complicated for others sort of thing

I: Yeah that makes sense so do you mean giving them too much at once….

Participant 1: Yeah too much at once sort of thing yeah it was emm I mean half the class it worked well with and the other half it was breaking it down into smaller steps and also it was putting it like into their language sort of thing so changing the name of like, instead of calling them loops calling them bunny ears and things like that sort of helped them and showing them how much they had to pull through so like, saying like only pull this much though cus like their little bit could still be like massive sort of thing (laughs) pulling the lace through so…

I: Yeah that makes a lot of sense as well, yeah thank you. Emm so did you notice any of the young people becoming more confident during the

intervention? Or calmer emm or do you think they still seemed uncertain when they

were approaching the task?

Participant 1: No a lot of them seemed to emm I mean I know one student in

particular as soon as he stepped up he did it and he was like right I know what I've

got to do now - he knew where he was going wrong each time and I could see him

saying it over and over to himself I've got to make sure I leave the hole there and then

I can poke that through so he was confident and he wasn't giving up on himself

where it had to go wrong so when he watched the video he really concentrated on that

particular bit but then it also helped by us saying right so you've got that bit now what

happens next when you watch the video makes sure you pay attention to that bit but

emm no I think a lot of them they were excited to do it more than anything cus its like

a gaming sort of sort of thing isn't it ?

I: Yeah, well that makes sense.

And was there any that kind of became less confident or less motivated as it went on?

Participant 1: Emm one student in particular he become, he wasn't very motivated

by it I don't think Emm purely because I don't think … because he's probably never

had to use this skill sort of thing he found it quite boring but he maybe only with one

session sometimes if you do two and I think that hindered him in a way because he

couldn't move forward emm so yeah.

I: Thank you that makes sense. Was there anything that you liked about the

intervention? Was there anything that you enjoyed while delivering it emm yeah was

there anything that you enjoyed about delivering it?

Participant 1: Yeah I think because it's a whole new way of learning cus its quite

boring sometimes to watch somebody do it all the time but to have that emm to see a

video.. cus the way the video was done it wasn't like looking over they could actually

feel like they was doing it themselves sort of thing when watching it. Emm and also I

haven't really seen anything taught that way through the headsets so that was quite…

I quite enjoyed that.

I: So it's easier for them to focus.

Participant 1: Yeah no it is ….

I: And the novelty factor of it …

Participant 1: Yeah that's it because it comes across as quite a fun thing to do like because I mean they are all into their games and stuff it was that exciting thing and I think it worked quite well we could use it in a lot of other ways to help support ….

I: What other ways do you think you could use it?

Participant 1: Emmm so a lot of our students they struggle going into new settings sort of thing but because you actually feel like you are in the room through the headset, although you're not, that would help them a lot because they'd be able to visualise themselves in that area and hopefully calm their anxieties down quite a bit so like we are going on a residential soon so that would really help them cus they could get familiar with the area and the space around them.

I: Yes, that's a good idea isn't it.

And was there anything that you didn't like about the intervention or anything to make you think I wouldn't use it again?

Participant 1: Personally I didn't think there was anything…. I'd probably like just maybe do a bit more so like how they tie their shoes so the skill they're learning see which method they're using rather than trying to change their method of how they do it and then adapting the videos even if it meant that you had to do more than one video for a certain skill for each child sort of thing so then their not… I know one student she had her mind set on this is how I am going to tie my shoelaces so adapting the video to suit her rather than teaching her a completely new method ….yeah

I: A completely new way of doing it ….That makes sense. Emm and what about if you were thinking of teaching another skill so I know you've mentioned using it in other ways

Participant 1: Yeah

I: Is there anything that would make you think no I won't use it for that for teaching that skill.

Participant 1: Emm Not really no cus I think it could be used for quite a bit emm because it is the new way I mean video gaming and all that its all in at the moment isn't it so actually they actually benefit and its quite fun thing to do rather than them

thinking oh I've got to learn a skill that's boring when listening to a teacher or constantly having someone telling them they feel like they are watching it through a game so its quite exciting

I: Yeah that makes sense. That's it. Thank you.

Participant 1: No, Thank you.

Interview transcript: Participant 2

I: So, I want to find out your views about the intervention that was delivered. So we are going to focus on the first part of the intervention where it was just the video but if you want to reflect on what kind of you did after and introduce the other elements to it as well then you can and as I said before if I ask you a question and you don't know how to answer or you are not sure or you just don't want to answer then you can just pass that question. If you want to leave at any time you can, just let me know okay.

So first of all then how do you think the children found the intervention?

Participant 2: I think they enjoyed it and I think it's good to incorporate you know something that's really modern and is like stuff that they do at home.

I: Yeah,

Participant 2: Like almost a game, like you know, a toy almost

I: Yeah,

Participant 2: Because, It's like something they'd enjoy to do and I think that's good you know and I like the concept using the, what's it called, headset, yeah.

I: Yeah, so

Participant 2: I think they like it as well, they like that they can use that and watch it through that

I: Yeah okay… and did they make progress through it or did certain individuals make progress?

Participant 2: Oh yeah, yeah they have made progress though it, I think, yeah and I think if it was a different activity err skill that they were learning they could probably, you know make more cus, its difficult when it's, when they are all doing the same thing

I: Yeah,

Participant 2: If they were all doing different things you would probably be able to see progress in different ways, do you know what I mean

I: Yeah, it's a difficult skill as well isn't it?

Participant 2: Yeah umm

I: It is a hard skill to learn the shoelaces, so that makes sense. So the ones who have learnt it then, because there have been a couple haven't there

Participant 2: Yeah

I: So have you seen those children use that skill other than during the sessions?

Participant 2: Well One child, she can do it now emm obviously she had done it at home hadn't she but then she learnt it your way didn't she and has done that in PE is that what you mean?

I: Yeah, yeah, yeah

Participant 2: Yeah she has done it in PE tying her own shoelaces…. I'm sure somebody else did as well in PE I can't remember who…

I: And is there anything they seemed to dislike about the intervention?

Participant 2: I can't like … nothing comes to mind emmm obviously one child didn't want to use the headset didn't he but

I: Yeah

Participant 2: that's just you know the headset itself its not the whole concept of learning through the… you know he wanted to do that so none of them disliked it.

I: Did the child every communicate why he want to wear the headset?

Participant 2: I think its just, you know his anxieties around well, he never said why but there had been a few times when had said no to things and you that others may just think of it as normal but yeah I think its just him ….

I: More of like the concept of having something new then… do you think rather than the headset itself?

Participant 2: Yeah I think so

I: That makes sense. Is there anything that they seemed to particularly enjoy?

Participant 2: Emm, well using it. I think that they liked that they can look around and its all like you're actually in a different place, and well it's the same place isn't it but you know, emm and yeah and learning a new skill as well…

I: And how did you find delivering the intervention then, so was it easy to understand kind of how to deliver it?

Participant 2: Emm overall yeah but like …at like it was like confusing to learn all the different like how to set it up and emm all of that and like making sure you are ticking as they do it its quite difficult isn't it to keep up emm….but yeah

I: Okay.. and was there anything that made it easier to deliver then?

Participant 2: I think the fact that they're just watching the video and they are like doing it themselves rather than you, you know, saying do this do that they're like, you are watching them learn themselves aren't you so its not, you don't have to, you know be on at them or be watching them, well you do watch them but you know what I mean like yeah…..

I: Yeah that makes sense

Participant 2: Let them watch it and then try and learn themselves kind of thing

I: Yeah, yeah and giving them the chance to do that... yeah that makes a lot of sense and was there anything that you felt could make it easier for you to do it next time. Is there anything that wasn't in place now that could make it easier in the future?

Participant 2: I don't know… I don't think so

I: Okay, okay So thinking about the young people when they were doing it then, so did you notice any of them become more confident or maybe less confident during the intervention?

Participant 2: Emm no, nothing comes to mind….

I: Okay and was there anything that you liked about the intervention at all

Participant 2: Well, I liked the headset that you use in that as I mentioned before that I'ts like something that they would use themselves and they can bring it to their learning kind of thing, yeah I liked that.

I: Yeah so the headset definitely emm was there anything that you didn't like about delivering the intervention or anything that might put you off using it again.

Participant 2: I think with this specific one like doing the shoelaces I think it was just the way that it was set out at first like the way that they had to tie it.

I: Yeah

Participant 2: But that's not really the actual intervention is it? Like that's just the specific

I: No, no that's part of it though isn't it. So there's definitely something about how you teach the skill

Participant 2: Yeah maybe like watching them do it first and then kind of teaching them based on what they already know do you know what I mean

I: Yeah that makes a lot of sense so yeah definitely thinking about how the skills taught

Participant 2: Yeah cus everyone learns differently don't they

I: Yeah

Participant 2: and obviously it would be hard for them to all learn like you would have to make a video per child wouldn't you but, and that wouldn't work..

I: It could do.

Participant 2: Well, yeah but it would be more difficult for you but I think that would be better because obviously they all do it differently don't they, do you know what I mean…

I: Yeah definitely so thinking about the skill and the child individually.

Participant 2: Yeah.

I: So if you were to use it again then are there any situations where you think it could be useful?

Participant 2: There was one that we were talking about when we first did this… I can't think of what it was. There are a lot of things that it could be used for though isn't there like us going to a new setting, getting used to it on the video first cus it actually feels like you are in a different place doesn't it. Emm just like overcoming anxieties about things I think it's good for and obviously learning new skills.

I: Yeah

Participant 2: I can't think of one skill like there was one that we spoke about but I can't think of what it is

I: That's okay but I think your point about overcoming anxiety is a good point as well. So do you see the benefit of this then being more for, kind of getting used to something that you might be anxious with or do you see it as more of a teaching skill thing or do you think it could be both?

Participant 2: I think both, I definitely think both yeah.

Interview transcript: Participant 3

I: thanks for agreeing to take part in the interview, I'm going ask you about your views regarding the first intervention but I know you have done things with it after

Participant 3: Yes

I: So we can talk about both but we'll just be clear about what we are talking about whether it's the first bit or the second part if there is anything that you don't want to answer then don't answer that's fine you don't have to you can pass and if you need to end the interview before the end, it will be about 10 minutes, but if you need to end the interview before then just let me know if you need to go anywhere else okay? So, first of all how do you think the children found the intervention then?

Participant 3: I think they enjoyed the thought of doing it and the actual process, going through the process I do I think they enjoy sort of having one to one sort of time so obviously they're used to interventions because obviously with the reading intervention. I think they have enjoyed it, there could be just a few frustrations on the way because they want results quick sometimes don't they children but no I think they actually enjoyed the intervention itself.

I: So they liked the one to one time err what about the technology then, did they seem to enjoy using that as well

Participant 3: Yeah, yeah I think in hindsight maybe looking at it and the group maybe the fact that they could see us behind and obviously that may have been for some of them a little bit of a distraction cus I think they enjoyed the fact that me and one of the children were still talking about they could see us in the (laughs) in the video behind sort of .. no I do think they actually enjoyed that I've never done anything like that before so obviously ….

I: Yeah, good and you said that that some of them became a bit frustrated then so…..

Participant 3: so like with one child he is obviously, he enjoyed it so he felt like he is going to go home and master it or find yeah… they want quick results don't they and I tend to find that with other interventions that we have done before they want the results quick

I: But yes, that's not always possible….

Participant 3: No of course not…

I: Yes, that makes sense. So did they make progress as a group? Did you see them kind of start to pick up the skill?

Participant 3: Emm slightly yeah. I think they all sort of got stuck on very very similar things

I: Yeah, so not all of them made progress then. It was just one really wasn't it then?

Participant 3: and we're not really 100% sure whether he had a little bit of an idea whether it was just confidence he needed that reassurance maybe or like an intervention putting in place so that he could actually achieve it really but…

I: Yeah that makes sense and that one child then have you seen them use the skill in other environments since that.

Participant 3: Yeah, yeah he started doing it in PE a lot more

I: So as a staff team how did you find delivering the intervention?

Participant 3: Yeah good, time consuming like any intervention its having to try and find the time within the…. obviously you know, we found the time but its time consuming because obviously you do have to talk them though it and its yeah….it was time consuming but definitely worthwhile doing though.

I: And in terms of the time constraints then, so how long was it taking to get through a child as a group then? To do an individual child.

Participant 3: Probably a good five minutes each child yeah, its just its trying to judge it with whatever else is going on in the class do you know what I mean, its just trying to… sometimes there are distractions. I think if it had been a blank room, we all said if it had maybe been a quiet space or somewhere outside the classroom maybe if we did it again that sort of thing a lot were concerned about what was going on behind them, what we are doing.

I: Yeah that's a potential distraction…

Participant 3: and obviously other things can come up with the day to day running of the school, so one of the girls had gone but were very very conscious that we wanted to get on with the intervention sometimes there are obviously two of us that we can be called off for something else emm and its just trying to fit it in then at another opportunity to fit it in throughout the day although our intention was to do it every morning as soon as they come in but it didn't always obviously work that way.

I: Yeah, no, no that makes sense. Emm so other than time was there anything else that you found about in the intervention that was a challenge.

Participant 3: No I mean obviously because they were showing them a certain way you quickly realised that maybe if we had showed them a different way…

I: Yeah

Participant 3: Obviously we weren't going to in that initial because obviously it was set up for that but you can quickly see oh if we changed it slightly they may get it …

I: Yeah

Participant 3: Because we could see they were all coming to a standstill at the same point. I think that was probably the frustrating bit it was if we tried to change this slightly now we may be able to but …

I: Yeah and using a different method in hindsight probably would have been better wouldn't it and you have done a different method since

Participant 3: Yeah

I: and have you seen more progress?

Participant 3: I wonder whether originally because of the age they are at and maybe we should have asked them which way, so some of them have maybe started doing and little bit and gone with the way that they have already known from a child but haven't been able to do … do you know.. does that make sense?

I: Yes

Participant 3: So you can see what their preference is... how would you like to learn you know a lot of them have got to that stage and I think it may be because of their previous knowledge of how to maybe that could have been confusing as well especially with one child going home and his parents saying oh I'll teach you a different way It gets them a little bit confused doesn't it?

I: Yeah that makes a lot of sense. In terms of kind of you delivering the intervention, I know you didn't deliver it yourself, but how easy did you find it to understand.

Participant 3: No, no easy yeah

I: So you felt like you would have been able to do it If you had had the chance.

Participant 3: No, of course yeah and with a completely different group of children it may have been a completely different it could had been….

I: Yeah. Was there anything about it that made it easier to deliver

Participant 3: Emm the coloured laces you know that was all very good and you know having the step by step instructions that was good. Emm no I think it was quite straightforward to deliver really.

I: Okay. Did you notice any of the young people becoming more confident while performing the skill and as the intervention went on or maybe less confident as the intervention went on?

Participant 3: Two yeah emm.

I: More confident or less?

Participant 3: No more confident, yeah more confident cus I don't think anybody I don't think everybody you know even if they haven't got the skill they have all tried you know they have all wanted to succeed. Emm maybe one was a little bit reluctant all along really

I: Yeah?

Participant 3: Yeah one young man was a little bit reluctant even when we changed the skill with the new skill it's still... not his thing …he doesn't particularly want to do it… I think he's that type of character with anything. I don't think it's just this I think its….just this intervention its self…

I: So motivation's an issue.

Participant 3: Motivation

I: Definitely okay. That makes a lot of sense. So was there anything that you liked about the intervention then?

Participant 3: I thought, so obviously like I say it's a completely new to me with the use of ICT and I think that has been, that has really engaged them I think you know . it would definitely be something I'd look at you know using in the future. If we could possibly you know try it with something else definitely.

I: And is there anything else that you think it would be particularly useful for?

Participant 3: Like we said before the transitions, transitional work and things like that I think that would be really good you know if we could video it and they could imagine actually being somewhere

I: Yeah

Participant 3: Or experience seeing that place numerous times before they actually, because a lot of our children do obviously struggle with transitions of going to new places.

I: Yeah, yeah that's a good idea so giving them chance to kind of witness it through the virtual reality.

Participant 3: Yeah

I: Are there any other skills that you think it could be useful for?

Participant 3: I don't know I suppose you could use it in anything really couldn't you. you could…. I don't know I wonder if you could use it with writing you know simple words, I don't know I never really thought about it. I suppose it would the concept its just over learning all the time, isn't it ..thats what it is, it just that and it has been proven that, you know like with the reading programme, that constantly doing something over and over again it does work with our pupils but it may just I don't know it may that their fine motor skills have restricted them more so that their ability to be able to get it… I think they all would know what they have got to do but it may just be…

I: Yeah,. That makes sense. So out of the two then you said that there is the confidence element of using it in the future and the skills side of things which, how do you see it being most useful. Do you see it as being more useful introducing a child to a new place or teaching them new skills or is it equal?

Participant 3: It going to be equal really but no emm no probably equal but I think it could definitely work with new skills. I would like to see it with maybe a few other skills and see if it works.

I: Yeah, okay. Was there anything that you didn't like about the intervention?

Participant 3: No, no I don't think I did.

I: Okay. So would you use it again?

Participant 3: Definitely, yeah definitely.

I: Would you use it for shoelaces again?

Participant 3: Maybe, but maybe like I said I'd probably find out where they are up to start with and maybe go with that approach, I know it's more work I think you'd have to do individualised programmes.

I: Yeah but its possible

Participant 3: Yeah I think at this stage if you were starting with a younger child who may not have the experience but I think because they have already got methods in their head and it was a complete new method I think they were trying to combine like I felt their existing knowledge with a new method which may have been quite confusing for some of them hence reverting back some of them to their old ways but ..

I: Yeah that makes sense, brilliant thank you.

Appendix 18- Coded transcripts

Initial Coding Participant 1

I : So how do you think the young people found the intervention?

Participant 1: I think they found it quite exciting (1)

I: Yeah

Particpant 1: They err no I don't think they've come across anything like that sort of thing so I think it was quite exciting for them. (2)

I: Yeah

Participant 1: I think some of them struggled at the beginning like, getting to like, because it was quite distracting in the room I suppose because there was other people (3) like in the video sort of thing but once they got used to that they had to look at the shoes or the cup of tea (laughs) they got it. (4)

I: So you got good levels of focus from them quite quickly.

Participant 1: Yeah, yeah, quite quickly, they picked it up quite quickly so…. (5)

I: That's good how many sessions do you think it took for them to kind of focus…..

Participant 1: Emm, probably about two maybe, a bit more with some of the others (5) but most of them it was about two.

I: Good okay and did they make progress from just watching the video?

Participant 1: Emm yes, some did Emm and then others it was maybe like taking a step back sort of thing instead of watching the video and doing the skill breaking it (6) down step by step to the same bits, to the same steps that were in the video but sort of modelling it to them.

I: Yep

Participant 1: But then the video also helped because they could see what was (7) happening sort of thing too but emm sort of taking that and unwind.. unpicking it sort of thing.

I: So you think having the video along side you doing it

Participant 1: Yeah modelling helps quite a bit

I: Yeah okay. And is there anything that they seemed to dislike about the intervention?

Participant 1: Emm sometimes they like… one student in particular it was the concentrating…. like if you had to do two sessions at a time he struggled with doing the two sessions. (8)

I: Yeah

Participant 1: Or like if the video was quite long it was that time, of like focusing on the video that's why like he worked better with the modelling because (9)

I: Yeah

Participant 1: It was like I do this now you do this for me sort of thing.

I: Yeah that makes sense. That makes a lot of sense actually. Emm and of the children who did learn it, have you seen them use that in other settings as well, so not just in the intervention in other…

Particpant 1: Yeah so emm we do forest schools where they have walking boots sometimes so a lot of the children have been tying up their own trainers or walking boots in that and before PE they have been transferring the skill there and if they have (10) ever worn trainers of their own to school they have transferred the skill to that which is good because then obviously it obviously hasn't got the coloured laces and they have transferred the skill to that without the coloured laces, they are learning how to do it without just coloured laces.

I: Yeah so they can make that step as well, that's good.

Participant 1: Yeah yeah

I: And in terms of you delivering the intervention then. How did you find delivering the intervention? Was it straight forward to understand, was it easy to understand first of all.

Participant 1: Emm it was, yeah it was easy to understand. It's just the whole set up of it obviously but the emm, the recording of it, because it was split into steps, it was (11) quite easy to follow so….

I: Yeah so is there anything that's part of the intervention that you think is, that you think was more challenging to deliver so …

Participant 1: Emm

I: Was the video okay to set up and administer….

Participant 1: Err yeah, no I found it quite easy to administer (13) sort of thing…yeah I found it was probably the just double checking it… that it was all alright after watching it sort of thing and what I did find tricky was you saying, asking if they can see whether they've cleared it but obviously you will never know whether it was clear (12) to them..

I: Yeah that is a good point

Participant 1: Sort of thing I'd never know whether it was or it wasn't or they were just saying it to make me happy (laughs)

I: Yeah, that's a really good point actually. I noticed that some of them were saying yes no matter what you said

Participant 1: Yeah that's it and you are like are you sure?

I: Yes that's a really good point. Was there anything that made it easier to deliver… was there anything that made it easy to understand?

Participant 1: Probably the way… like how you have to tick off the skill, like step by step emm and how it was worded and also I like the fact that emm they watch it through the video and how you can set it up through like the remote sort of thing but the only thing that I used forget that you had to face the same way didn't you (14)

I: Yeah

Participant 1: So you had to make sure you were facing the same way you and make sure you always had it in that in that section but no I think to be fair I think it was quite easy to set up yeah

I: Is there anything that you think could be better about delivering it?

Participant 1: Emm I think the first method was emm good for some of the children and then maybe it was a bit complicated for others sort of thing (15)

I: Yeah that makes sense so do you mean giving them too much at once….

Participant 1: Yeah too much at once sort of thing yeah it was emm I mean half the class it worked well with and the other half it was breaking it down into smaller steps and also it was putting it like into their language sort of thing so changing the name of like, instead of calling them loops calling them bunny ears and things like that sort of helped them and showing them how much they had to pull through so like, saying like only pull this much though cus like their little bit could still be like massive sort of thing (laughs) pulling the lace through so… (6) (17)

I: Yeah that makes a lot of sense as well, yeah thank you.
Emm so did you notice any of the young people becoming more confident during the intervention? Or calmer emm or do you think they still seemed uncertain when they were approaching the task?

Participant 1: No a lot of them seemed to emm I mean I know one student in particular as soon as he stepped up he did it and he was like right I know what I've got to do now - he knew where he was going wrong each time and I could see him saying it over and over to himself I've got to make sure I leave the hole there and then I can poke that through so he was confident and he wasn't giving up on himself where it had to go wrong so when he watched the video he really concentrated on that particular bit but then it also helped by us saying right so you've got that bit now what happens next when you watch the video makes sure you pay attention to that bit but

emm no I think a lot of them they were excited to do it more than anything cus its like a gaming sort of sort of thing isn't it ?

I: Yeah, well that makes sense.
And was there any that kind of became less confident or less motivated as it went on?

Participant 1: Emm one student in particular he become, he wasn't very motivated by it I don't think Emm purely because I don't think … because he's probably never had to use this skill sort of thing he found it quite boring but he maybe only with one session sometimes if you do two and I think that hindered him in a way because he couldn't move forward emm so yeah.

I: Thank you that makes sense. Was there anything that you liked about the intervention? Was there anything that you enjoyed while delivering it emm yeah was there anything that you enjoyed about delivering it?

Participant 1: Yeah I think because it's a whole new way of learning cus its quite boring sometimes to watch somebody do it all the time but to have that emm to see a video... cus the way the video was done it wasn't like looking over they could actually feel like they was doing it themselves sort of thing when watching it. Emm and also I haven't really seen anything taught that way through the headsets so that was quite… I quite enjoyed that.

I: So it's easier for them to focus.

Participant 1: Yeah no it is ….

I: And the novelty factor of it …

Participant 1: Yeah that's it because it comes across as quite a fun thing to do like because I mean they are all into their games and stuff it was that exciting thing and I think it worked quite well we could use it in a lot of other ways to help support ….

I: What other ways do you think you could use it?

Participant 1: Emmm so a lot of our students they struggle going into new settings sort of thing but because you actually feel like you are in the room through the headset, although you're not, that would help them a lot because they'd be able to visualise themselves in that area and hopefully calm their anxieties down quite a bit so like we are going on a residential soon so that would really help them cus they could get familiar with the area and the space around them.

I: Yes, that's a good idea isn't it.
And was there anything that you didn't like about the intervention or anything to make you think I wouldn't use it again?

Participant 1: Personally I didn't think there was anything…. I'd probably like just maybe do a bit more so like how they tie their shoes so the skill they're learning see which method they're using rather than trying to change their method of how they do it and then adapting the videos even if it meant that you had to do more than one

video for a certain skill for each child sort of thing so then their not… I know one student she had her mind set on this is how I am going to tie my shoelaces so adapting the video to suit her rather than teaching her a completely new method ….yeah

I: A completely new way of doing it ….That makes sense. Emm and what about if you were thinking of teaching another skill so I know you've mentioned using it in other ways

Participant 1: Yeah

I: Is there anything that would make you think no I won't use it for that for teaching that skill.

Participant 1: Emm Not really no cus I think it could be used for quite a bit emm because it is the new way I mean video gaming and all that its all in at the moment isn't it so actually they actually benefit and its quite fun thing to do rather than them thinking oh I've got to learn a skill that's boring when listening to a teacher or constantly having someone telling them they feel like they are watching it through a game so its quite exciting 25

I: Yeah that makes sense. That's it. Thank you.

Participant 1: No, Thank you.

Initial Coding Participant 2

I: So, I want to find out your views about the intervention that was delivered. So we are going to focus on the first part of the intervention where it was just the video but if you want to reflect on what kind of you did after and introduce the other elements to it as well then you can and as I said before if I ask you a question and you don't know how to answer or you are not sure or you just don't want to answer then you can just pass that question. If you want to leave at any time you can, just let me know okay. So first of all then how do you think the children found the intervention?

Participant 2: I think they enjoyed it and I think it's good to incorporate you know something that's really modern and is like stuff that they do at home. 1

I: Yeah,

Participant 2: Like almost a game, like you know, a toy almost 2

I: Yeah,

Participant 2: Because, It's like something they'd enjoy to do and I think that's good you know and I like the concept using the, what's it called, headset, yeah.

I: Yeah, so

Participant 2: I think they like it as well, they like that they can use that and watch it through that 3.

I: Yeah okay… and did they make progress through it or did certain individuals make progress?

Participant 2: Oh yeah, yeah they have made progress though it, I think, yeah and I think if it was a different activity err skill that they were learning they could probably, you know make more cus, its difficult when it's, when they are all doing the same thing

I: Yeah,

Participant 2: If they were all doing different things you would probably be able to see progress in different ways, do you know what I mean

I: Yeah, it's a difficult skill as well isn't it?

Participant 2: Yeah umm

I: It is a hard skill to learn the shoelaces, so that makes sense. So the ones who have learnt it then, because there have been a couple haven't there

Participant 2: Yeah

I: So have you seen those children use that skill other than during the sessions?

Participant 2: Well One child, she can do it now emm obviously she had done it at home hadn't she but then she learnt it your way didn't she and has done that in PE is that what you mean?

I: Yeah, yeah, yeah

Participant 2: Yeah she has done it in PE tying her own shoelaces…. I'm sure somebody else did as well in PE I can't remember who…

I: And is there anything they seemed to dislike about the intervention?

Participant 2: I can't like … nothing comes to mind emmm obviously one child didn't want to use the headset didn't he but 4

I: Yeah

Participant 2: that's just you know the headset itself its not the whole concept of learning through the… you know he wanted to do that so none of them disliked it.

I: Did the child every communicate why he want to wear the headset?

Participant 2: I think its just, you know his anxieties around well, he never said why but there had been a few times when had said no to things and you that others may 4 just think of it as normal but yeah I think its just him ….

I: More of like the concept of having something new then… do you think rather than the headset itself?

Participant 2: Yeah I think so

I: That makes sense. Is there anything that they seemed to particularly enjoy?

Participant 2: Emm, well using it. I think that they liked that they can look around and its all like you're actually in a different place, and well it's the same place isn't it but you know, emm and yeah and learning a new skill as well.. 5

I: And how did you find delivering the intervention then, so was it easy to understand kind of how to deliver it?

Participant 2: Emm overall yeah but like …at like it was like confusing to learn all the different like how to set it up and emm all of that and like making sure you are ticking as they do it its quite difficult isn't it to keep up emm….but yeah 6

I: Okay.. and was there anything that made it easier to deliver then?

Participant 2: I think the fact that they're just watching the video and they are like doing it themselves rather than you, you know, saying do this do that they're like, you are watching them learn themselves aren't you so its not, you don't have to, you 7

know be on at them or be watching them, well you do watch them but you know what I mean like yeah…..

I: Yeah that makes sense

Participant 2: Let them watch it and then try and learn themselves kind of thing

I: Yeah, yeah and giving them the chance to do that... yeah that makes a lot of sense and was there anything that you felt could make it easier for you to do it next time. Is there anything that wasn't in place now that could make it easier in the future?

Participant 2: I don't know… I don't think so

I: Okay, okay So thinking about the young people when they were doing it then, so did you notice any of them become more confident or maybe less confident during the intervention?

Participant 2: Emm no, nothing comes to mind….

I: Okay and was there anything that you liked about the intervention at all

Participant 2: Well, I liked the headset that you use in that as I mentioned before that I'ts like something that they would use themselves and they can bring it to their learning kind of thing, yeah I liked that.

I: Yeah so the headset definitely emm was there anything that you didn't like about delivering the intervention or anything that might put you off using it again.

Participant 2: I think with this specific one like doing the shoelaces I think it was just the way that it was set out at first like the way that they had to tie it.

I: Yeah

Participant 2: But that's not really the actual intervention is it? Like that's just the specific

I: No, no that's part of it though isn't it. So there's definitely something about how you teach the skill

Participant 2: Yeah maybe like watching them do it first and then kind of teaching them based on what they already know do you know what I mean

I: Yeah that makes a lot of sense so yeah definitely thinking about how the skills taught

Participant 2: Yeah cus everyone learns differently don't they

I: Yeah

Participant 2: and obviously it would be hard for them to all learn like you would have to make a video per child wouldn't you but, and that wouldn't work..

I: It could do.

Participant 2: Well, yeah but it would be more difficult for you but I think that would be better because obviously they all do it differently don't they, do you know what I mean…

I: Yeah definitely so thinking about the skill and the child individually.

Participant 2: Yeah.

I: So if you were to use it again then are there any situations where you think it could be useful?

Participant 2: There was one that we were talking about when we first did this… I can't think of what it was. There are a lot of things that it could be used for though isn't there like us going to a new setting, getting used to it on the video first cus it actually feels like you are in a different place doesn't it. Emm just like overcoming anxieties about things I think it's good for and obviously learning new skills.

I: Yeah

Participant 2: I can't think of one skill like there was one that we spoke about but I can't think of what it is

I: That's okay but I think your point about overcoming anxiety is a good point as well. So do you see the benefit of this then being more for, kind of getting used to something that you might be anxious with or do you see it as more of a teaching skill thing or do you think it could be both?

Participant 2: I think both, I definitely think both yeah.

3

Initial Coding Participant 3

I: thanks for agreeing to take part in the interview, I'm going ask you about your views regarding the first intervention but I know you have done things with it after

Participant 3: Yes

I: So we can talk about both but we'll just be clear about what we are talking about whether it's the first bit or the second part if there is anything that you don't want to answer then don't answer that's fine you don't have to you can pass and if you need to end the interview before the end, it will be about 10 minutes, but if you need to end the interview before then just let me know if you need to go anywhere else okay? So, first of all how do you think the children found the intervention then?

Participant 3: I think they enjoyed the thought of doing it and the actual process, (1) going through the process I do I think they enjoy sort of having one to one sort of time so obviously they're used to interventions because obviously with the reading intervention. I think they have enjoyed it, there could be just a few frustrations on (2) the way because they want results quick sometimes don't they children but no I think they actually enjoyed the intervention itself.

I: So they liked the one to one time err what about the technology then, did they seem to enjoy using that as well

Participant 3: Yeah, yeah I think in hindsight maybe looking at it and the group maybe the fact that they could see us behind and obviously that may have been for (3) some of them a little bit of a distraction cus I think they enjoyed the fact that me and one of the children were still talking about they could see us in the (laughs) in the video behind sort of .. no I do think they actually enjoyed that I've never done anything like that before so obviously ….

I: Yeah, good and you said that that some of them became a bit frustrated then so…..

Participant 3: so like with one child he is obviously, he enjoyed it so he felt like he is (5) going to go home and master it or find yeah… they want quick results don't they and I tend to find that with other interventions that we have done before they want the results quick

I: But yes, that's not always possible….

Participant 3: No of course not…

I: Yes, that makes sense. So did they make progress as a group? Did you see them kind of start to pick up the skill?

Participant 3: Emm slightly yeah. I think they all sort of got stuck on very very (4) similar things

I: Yeah, so not all of them made progress then. It was just one really wasn't it then?

Participant 3: and we're not really 100% sure whether he had a little bit of an idea whether it was just confidence he needed that reassurance maybe or like an intervention putting in place so that he could actually achieve it really but… 6

I: Yeah that makes sense and that one child then have you seen them use the skill in other environments since that.

Participant 3: Yeah, yeah he started doing it in PE a lot more 7

I: So as a staff team how did you find delivering the intervention?

Participant 3: Yeah good, time consuming like any intervention its having to try and find the time within the…. obviously you know, we found the time but its time consuming because obviously you do have to talk them though it and its yeah….it was time consuming but definitely worthwhile doing though. 8

I: And in terms of the time constraints then, so how long was it taking to get through a child as a group then? To do an individual child.

Participant 3: Probably a good five minutes each child yeah, its just its trying to judge it with whatever else is going on in the class do you know what I mean, its just trying to… sometimes there are distractions. I think if it had been a blank room, we all said if it had maybe been a quiet space or somewhere outside the classroom maybe if we did it again that sort of thing a lot were concerned about what was going on behind them, what we are doing. 9

I: Yeah that's a potential distraction…

Participant 3: and obviously other things can come up with the day to day running of the school, so one of the girls had gone but were very very conscious that we wanted to get on with the intervention sometimes there are obviously two of us that we can be called off for something else emm and its just trying to fit it in then at another opportunity to fit it in throughout the day although our intention was to do it every morning as soon as they come in but it didn't always obviously work that way. 10

I: Yeah, no, no that makes sense. Emm so other than time was there anything else that you found about in the intervention that was a challenge.

Participant 3: No I mean obviously because they were showing them a certain way you quickly realised that maybe if we had showed them a different way… 11

I: Yeah

Participant 3: Obviously we weren't going to in that initial because obviously it was set up for that but you can quickly see oh if we changed it slightly they may get it …

I: Yeah

Participant 3: Because we could see they were all coming to a standstill at the same point. I think that was probably the frustrating bit it was if we tried to change this slightly now we may be able to but …

I: Yeah and using a different method in hindsight probably would have been better wouldn't it and you have done a different method since

Participant 3: Yeah

I: and have you seen more progress?

Participant 3: I wonder whether originally because of the age they are at and maybe we should have asked them which way, so some of them have maybe started doing and little bit and gone with the way that they have already known from a child but haven't been able to do … do you know.. does that make sense?

I: Yes

Participant 3: So you can see what their preference is... how would you like to learn you know a lot of them have got to that stage and I think it may be because of their previous knowledge of how to maybe that could have been confusing as well especially with one child going home and his parents saying oh I'll teach you a different way It gets them a little bit confused doesn't it?

I: Yeah that makes a lot of sense. In terms of kind of you delivering the intervention, I know you didn't deliver it yourself, but how easy did you find it to understand.

Participant 3: No, no easy yeah

I: So you felt like you would have been able to do it If you had had the chance.

Participant 3: No, of course yeah and with a completely different group of children it may have been a completely different it could had been….

I: Yeah. Was there anything about it that made it easier to deliver

Participant 3: Emm the coloured laces you know that was all very good and you know having the step by step instructions that was good. Emm no I think it was quite straightforward to deliver really.

I: Okay. Did you notice any of the young people becoming more confident while performing the skill and as the intervention went on or maybe less confident as the intervention went on?

Participant 3: Two yeah emm.

I: More confident or less?

Participant 3: No more confident, yeah more confident cus I don't think anybody I don't think everybody you know even if they haven't got the skill they have all tried

you know they have all wanted to succeed. Emm maybe one was a little bit reluctant all along really

I: Yeah?

Participant 3: Yeah one young man was a little bit reluctant even when we changed the skill with the new skill it's still... not his thing …he doesn't particularly want to do it… I think he's that type of character with anything. I don't think it's just this I think its….just this intervention its self…

I: So motivation's an issue.

Participant 3: Motivation

I: Definitely okay. That makes a lot of sense. So was there anything that you liked about the intervention then?

Participant 3: I thought, so obviously like I say it's a completely new to me with the use of ICT and I think that has been, that has really engaged them I think you know . it would definitely be something I'd look at you know using in the future. If we could possibly you know try it with something else definitely.

I: And is there anything else that you think it would be particularly useful for?

Participant 3: Like we said before the transitions, transitional work and things like that I think that would be really good you know if we could video it and they could imagine actually being somewhere

I: Yeah

Participant 3: Or experience seeing that place numerous times before they actually, because a lot of our children do obviously struggle with transitions of going to new places.

I: Yeah, yeah that's a good idea so giving them chance to kind of witness it through the virtual reality.

Participant 3: Yeah

I: Are there any other skills that you think it could be useful for?

Participant 3: I don't know I suppose you could use it in anything really couldn't you. you could…. I don't know I wonder if you could use it with writing you know simple words, I don't know I never really thought about it. I suppose it would the concept its just over learning all the time, isn't it ..thats what it is, it just that and it has been proven that, you know like with the reading programme, that constantly doing something over and over again it does work with our pupils but it may just I don't know it may that their fine motor skills have restricted them more so that their ability

to be able to get it… I think they all would know what they have got to do but it may just be…

I: Yeah,. That makes sense. So out of the two then you said that there is the confidence element of using it in the future and the skills side of things which, how do you see it being most useful. Do you see it as being more useful introducing a child to a new place or teaching them new skills or is it equal?

Participant 3: It going to be equal really but no emm no probably equal but I think it could definitely work with new skills. I would like to see it with maybe a few other skills and see if it works.

I: Yeah, okay. Was there anything that you didn't like about the intervention?

Participant 3: No, no I don't think I did.

I: Okay. So would you use it again?

Participant 3: Definitely, yeah definitely.

I: Would you use it for shoelaces again?

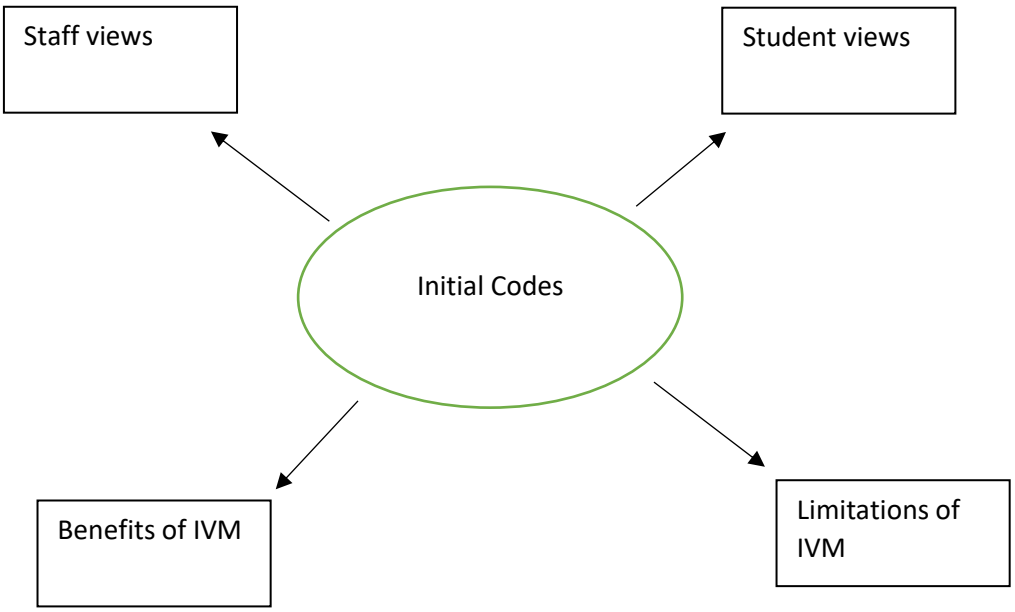
Participant 3: Maybe, but maybe like I said I'd probably find out where they are up to start with and maybe go with that approach, **I know it's more work I think you'd have to do individualised programmes.** 21

I: Yeah but its possible

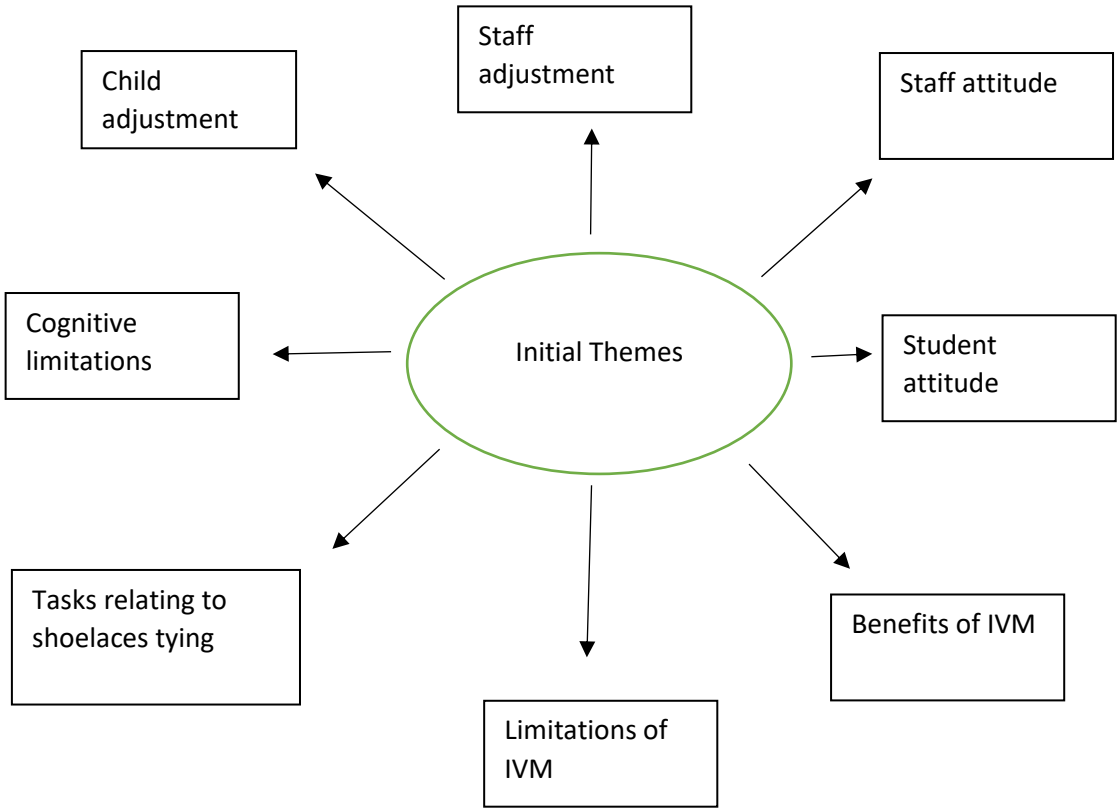
Participant 3: Yeah I think at this stage if you were starting with a younger child who may not have the experience but I think because they have already got methods in their head and it was a complete new method I think they were trying to combine like **I felt their existing knowledge with a new method which may have been quite confusing for some of them hence reverting back some of them to their old ways but ..**

I: Yeah that makes sense, brilliant thank you.

Appendix 19- Initial codes



Appendix 20- Initial themes



When initial themes were reviewed a number of themes were removed, combined or split. This text aims to provide a summary of this process.

The theme “tasks relating to shoelaces” was split into an over arching theme “task”. This theme was then further refined to include two sub-themes “skill” and “systematic instruction”, this allowed data regarding the skill (shoelace tying) and systematic instruction to be separated allowing for more detailed analysis.

The theme “staff attitude” was renamed to “staff views” as was felt that this captured the essence of the theme better. Furthermore, data in this theme was split in to coherent groups with formed three sub-themes “pedagogy”, “motivation for use” and “future uses”. Three coded items the “benefits of IVM” theme were also included within this theme as it provided a better description of this data.

The “staff adjustment” theme was renamed to “implementation” as data within this theme reflected staffs experiences of implementing IMV. One extract from “limitations of IVM” and two extracts were taken from “benefits of IVM”.

The themes “student adjustment” and “cognitive limitations” were combined to form the theme “presence”. Two sub-themes were identified within this theme, “environmental influences” and “factors in video”.

Two extracts were taken from “benefits of IVM” and were used to form the theme “generalisation” as this captured the unique nature of this theme.

The theme “student attitude” was kept as the main theme, however, two sub-themes were formed to better capture the data, these were, “attitude towards technology” and “attitude towards intervention”.

Appendix 21- Application for ethical review

UNIVERSITY OF BIRMINGHAM

APPLICATION FOR ETHICAL REVIEW

This form is to be completed by PIs or supervisors (for PGR student research) who have completed the University of Birmingham's Ethical Review of Research Self Assessment Form (SAF) and have decided that further ethical review and approval is required before the commencement of a given Research Project.

Please be aware that all new research projects undertaken by postgraduate research (PGR) students first registered as from 1st September 2008 will be subject to the University's Ethical Review Process. PGR students first registered before 1st September 2008 should refer to their Department/School/College for further advice.

Researchers in the following categories are to use this form:

1. The project is to be conducted by:
    - staff of the University of Birmingham; or
    - postgraduate research (PGR) students enrolled at the University of Birmingham (to be completed by the student's supervisor);
2. The project is to be conducted at the University of Birmingham by visiting researchers.

Students undertaking undergraduate projects and taught postgraduate (PGT) students should refer to their Department/School for advice.

NOTES:

- An electronic version of the completed form should be submitted to the Research Ethics Officer, at the following email address: aer-ethics@contacts.bham.ac.uk. Please **do not** submit paper copies.
- If, in any section, you find that you have insufficient space, or you wish to supply additional material not specifically requested by the form, please it in a separate file, clearly marked and attached to the submission email.
- If you have any queries about the form, please address them to the Research Ethics Team.

☒ **Before submitting, please tick this box to confirm that you have consulted and understood the following information and guidance and that you have taken it into account when completing your application:**

- **The information and guidance provided on the University's ethics webpages (https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-of-Research.aspx)**

UNIVERSITY OF BIRMINGHAM **APPLICATION FOR ETHICAL REVIEW**	*OFFICE USE ONLY:* Application No: Date Received:

1. TITLE OF PROJECT

Immersive video modelling: evaluating the application of using a video modelling intervention to teach functional skills in a specialist secondary setting

2. THIS PROJECT IS:

University of Birmingham Staff Research project ☐
University of Birmingham Postgraduate Research (PGR) Student project ☒
Other ☐ (Please specify):

3. INVESTIGATORS

a) PLEASE GIVE DETAILS OF THE PRINCIPAL INVESTIGATORS OR SUPERVISORS (FOR PGR STUDENT PROJECTS)

Name: Title / first name / family name	Anita Soni	
Highest qualification & position held:	Academic and professional supervisor	
School/Department	Education -DISN	
Telephone:	0121 414 3603	
Email address:	a.soni@birmingham.ac.uk	

Name: Title / first name / family name	
Highest qualification & position	
School/Department	
Telephone:	
Email address:	

b) PLEASE GIVE DETAILS OF ANY CO-INVESTIGATORS OR CO-SUPERVISORS (FOR PGR STUDENT PROJECTS)

Name: Title / first name / family name	
Highest qualification & position	
School/Department	
Telephone:	
Email address:	

c) In the case of PGR student projects, please give details of the student

Name of	Daniel Hawkins	Student	
Course of	Ap.Ed & Child	Email	Dxh623@student.bha,.ac.uk
Principal	Anita Soni		

Name of student:		Student No:	
Course of study:		Email	
Principal			

4. ESTIMATED START OF PROJECT Date: May 2018

ESTIMATED END OF PROJECT Date: May 2019

FUNDING

List the funding sources (including internal sources) and give the status of each source.

Funding Body	Approved/Pending /To be submitted
PGR development fund (funding for camera)	Approved

If you are requesting a quick turnaround on your application, please explain the reasons below (including funding-related deadlines). You should be aware that whilst effort will be made in cases of genuine urgency, it will not always be possible for the Ethics Committees to meet such requests.

I aim to collect my data in the summer term of the 2017-2018 academic year. Therefore, a delayed response will prevent me from being able to collect my data within my intended time frame.

5. SUMMARY OF PROJECT

Describe the purpose, background rationale for the proposed project, as well as the hypotheses/research questions to be examined and expected outcomes. This description should be in everyday language that is free from jargon. Please explain any technical terms or discipline-specific phrases.

This research project aims to evaluate the efficacy of a new intervention developed by the author: immersive video modelling. Immersive video modelling combines two evidence based approaches- Video Modelling and Virtual Reality Therapy. Video Modelling involves presenting a participant with a video of somebody completing a skill. By watching these videos it has been found that children are able to learn the observed skill (Bellini & Akullian, 2007). Virtual Reality Therapy is a technique that places participants in a virtual environment using a virtual reality headset. It has been found to be an effective treatment for children with acute anxiety, producing comparable results to Cognitive Behavioural Therapy (Klinger et al., 2005). Immersive video modelling presents a first person video of an individual carrying out a target skill. The participant watches this through a virtual reality headset. It is hypothesised that this intervention will result in skill acquisition and will reduce anxiety/apprehension around completing the skill.

This research aims to outline a clear procedure for immersive video modelling that is informed by the findings of pervious research (for example the recommended procedures put forward by Hitchcock, Dowrick and Prater, 2003). It also aims to assess the efficacy of immersive video modelling. In addition, social anxiety levels will be assessed using a 1-10 nervous/confident scale to determine the intervention increase confidence. Furthermore, information relating to the experiences of the staff carrying out the intervention will also be acquired and evaluated this will provide the researcher with a qualitative understanding of individuals delivering the interventions perspective.

This study has the following hypothesis:

8) immersive video modelling conditions will significantly improve independence skills from baseline levels
9) Immersive video modelling will lead to increased generalisation of skills
10) Immersive video modelling will result in skills being maintained following the intervention
11) Access to immersive video will reduce social anxiety/increase confidence in relation to the target skill

This study also has the following research questions:

1) What are the experiences of individuals implementing an immersive video modelling intervention?
2) How do the experiences of individuals implementing an immersive video modelling intervention align with the theory that underpins immersive vide modelling?

6. CONDUCT OF PROJECT

Please give a description of the research methodology that will be used

Research design

My research will use a mixed methods approach. The study will divided into two parts, the experimental phase and the evaluative phase.

The experimental phase

The experimental phase employ a multiple baseline quasi-experimental case study design to evaluate the efficacy of immersive video modelling. The independent variable will be the immersive video modelling intervention delivered during the intervention phase. Baseline measures will be taken for individual skills before the intervention. There will be five dependent variables:

- Progress in in the experimental conditions will be measured using an observation checklist that scores skill acquisition, this will be based on a task analysis of the target skills; breaking it down into smaller chunks.
- The number of sessions taken to achieve the mastery criterion (80% success rate for three consecutive sessions).
- The change in anxiety/confidence rating scores (these rating will be taken after every session).
- The participants ability to generalise skills to different settings and different people (this measure will be take after the participant has reached the mastery criterion).
- The participant's ability to maintain the skill three weeks after their last exposure to the intervention.

Types of skill acquisition

The experiment aims to teach target skills to participants', however these target skills are yet to be defined due to the diverse nature of the participants. The case study design will allow interventions to be tailored to the needs of each participant, thus making it impossible to name the target skills for the study at this time. However, skills must meet certain criteria:

- They must have functional value for the participant, they must be skills that will be used by the participant in the future.
- They must involve a chain of activities that can be task sliced.
- They may involve some social elements but they cannot be purely social in their nature (such as having a conversation).

Examples of suitable target skills include, buying an item in a shop, lining up for lunch, getting on the bus, using an or travelling to a new location (such as a room in their school).

Procedure

Baseline- Participants will be placed in an environment in which they are expected to carry out the target skill. They will be given a short instruction to carry out the target skill e.g. "buy a chocolate bar". The progress will then be recorded using an observation checklist. Non-descriptive verbal praise will be used if the participant completes an item on the checklist for example "well done". This phase will take place three times to ensure that the baseline result is an accurate reflection of the participants ability.

Immersive video modelling- During this condition participants will have access to an instructional session where they will be presented with the immersive video model. The video will be recorded using a 360' degree camera held at the participants eye level. The target skill will recorded from a first person perspective. The researcher will serve as the model in the videos, although their face will not be in the videos, participants will be able to see the researchers hands interacting with the environment. Participants will watch the videos through a virtual reality headset with an encrypted local authority owned phone serving as the screen.

The intervention be delivered daily. They will then be immediately followed by an assessment session in which the participant will be asked to carry out the target skill. Participants will watch the video twice and the video will contain narration. The video will also be projected onto a screen so the facilitator can ensure that the participant is attending to the correct part of the video. The assessment of this phase will follow the same procedure as the baseline phase and will continue until the participant reaches the success criterion (80% success rate over 3 sessions) The participant will be assessed daily following the intervention. The intervention will be discontinued if the participant fails to make progress over 5 consecutive sessions or if the intervention exceeds 20 sessions.

Generalisation- Generalisation of the skills taught during the intervention will be measured once after the participant archives the mastery criterion. Participants will be asked to carry out the skills in a different setting and/or with a different person. The same behavioural checklist will be used to measure if the participant is able to successfully generalise these skills. If a participant meets the discontinue criteria they will not go forward to this part of the study.

Maintenance- The maintenance phase will follow the same procedure as the baseline phase. It will take place three weeks after the final intervention session to measure if the participant has retained the skills they acquired during the intervention. If a participant meets the discontinue criteria they will not go forward to this part of the study.

Fidelity measures- Sessions will be recorded to assess reliability and validity. Inter-observer reliability will be measured by presenting a second observer with a video of the target behaviour. They will complete the same checklist as the observer. The results of these checklists will then be used to assess inter-rater reliability. This will be carried out for 20% of sessions, each participant will be included in these sessions.

Recordings of sessions will also be used to measure the social validity of the target behaviours. Participants will be recorded at various stages of skill acquisition. This video will then be presented to staff in the participating school. They will be provided with a questionnaire that aims to establish if the skills demonstrated are more socially valid in the later stages of the intervention.

The evaluative phase

The evaluative phase will use interview data obtained from two participants who oversaw the intervention to obtain an understanding of the perceptions of the staff who oversaw the video modelling intervention and evaluate their experiences of delivering the intervention.

7. DOES THE PROJECT INVOLVE PARTICIPATION OF PEOPLE OTHER THAN THE

RESEARCHERS AND SUPERVISORS?

Yes ☒ No ☐

Note: 'Participation' includes both active participation (such as when participants take part in an interview) and cases where participants take part in the study without their knowledge and consent at the time (for example, in crowd behaviour research).

If you have answered NO please go to Section 18. If you have answered YES to this question please complete all the following sections.

8. PARTICIPANTS AS THE SUBJECTS OF THE RESEARCH

Describe the number of participants and important characteristics (such as age, gender, location, affiliation, level of fitness, intellectual ability etc.). Specify any inclusion/exclusion criteria to be used.

Participants for the experimental phase will be recruited from a local secondary school specialising in supporting children with moderate to severe learning difficulties. Participants for the experimental phase will be recruited based upon their development in the target skills, only individuals who are yet to develop the target skills will be selected for the study. Participants will be required to meet the pre-requisite criteria for video modelling interventions (as outlined by Macdonald, Dickson, Martineau and Ahern, 2015), these are:

- Ability to attend to a stimuli for 3 minutes- this will be measured by exposing the individual to an interesting video for 3 minutes
- Delayed matching to sample (DMTS) ability- this will be assessed using a delayed picture matching activity. Participants will be required to achieve a score of 50% or higher in this task to be selected for the study
- All participants must feel comfortable wearing a virtual reality headset
- They must all be able to imitate another person completing an activity.

In addition, participants' anxiety levels will also be assessed. Any participants who are reported by parents or school staff to have high levels of anxiety will be excluded from the study as it may inadvertently place them in a social scenario that will further increase anxiety levels. Initial information about if the child meets these criteria will be obtained through consultation with school staff. Once parental and child consent will be obtained the researcher will assess participants to see if they meet this criteria.

Two members of staff will be recruited through the school for the evaluative phase of the study. They will have overseen the intervention and will agree to be interviewed prior to the experimental phase (although they reserve their right to withdraw from the study at any time).

9. RECRUITMENT

Please state clearly how the participants will be identified, approached and recruited. Include any relationship between the investigator(s) and participant(s) (e.g. instructor-student).

Note: Attach a copy of any poster(s), advertisement(s) or letter(s) to be used for recruitment.

Participants will be recruited through the school in which the research will take place. The researcher is currently on placement in the Local Authority the study is taking place in. Consequently, they have contact with the school through their role. The school will identify potential participants for both phases. The researcher will then approach the participants to acquire fully informed consent and assess suitability

10. CONSENT

a) Describe the process that the investigator(s) will be using to obtain valid consent. If consent is not to be obtained explain why**.** If the participants are minors or for other reasons are not competent to consent, describe the proposed alternate source of consent, including any permission / information letter to be provided to the person(s) providing the consent.

Experimental phase- Where possible child participants will provide informed consent to take part in the study. They will have materials differentiated to an appropriate level to ensure that they are accessible (Appendix 1). In addition, parental consent will be acquired from all participants in the experimental condition (see Appendix 2) parents will be fully informed of the study's nature through an information sheet (appendix 3)

Evaluative phase- Al participants will provide fully informed consent to take part in the study. The nature of the study and their rights will be explained verbally (see appendix 4). They will be asked to sign a consent form (appendix 5).

Consent to be recorded- All videos will be recorded in public places. Some individuals will be active participants in the video for example, a shop assistant who interacts with the person carrying out the skill. Informed consent will be obtained from all participants who interact directly with the camera. However, as the recordings are in a public place other individuals may be incidentally included in the for video, example, a shopper in the background. In line with the BBC's editorial guidelines, consent for these individuals is not required from these individuals as:
a) they are in a public place
b) they are in a public place that does not imply a certain level of privacy (an example of a place that implies privacy could include a location where medical treatment is provided).
c) they are not distressed
d) they are not being presented in an unfair light

To protect the privacy of members of the public in the filming location and inform them that I am recording the following measures will be taken:

Note: Attach a copy of the Participant Information Sheet (if applicable), the Consent Form (if applicable), the content of any telephone script (if applicable) and any other material that will be used in the consent process.

b) Will the participants be deceived in any way about the purpose of the study?
Yes ☐ **No** ☒

If yes, please describe the nature and extent of the deception involved. Include how and when the deception will be revealed, and who will administer this feedback.

11. PARTICIPANT FEEDBACK

Explain what feedback/ information will be provided to the participants after participation in the research. (For example, a more complete description of the purpose of the research, or access to the results of the research).

Participants in the experimental phase will be given feedback about their individual progress. This will be presented in a written format that is accessible for the participant. Participants in the experimental phase will receive a research report, the same report will be given to senior staff in the participating school. The research report will be presented in an leaflet format and will contain a summary of the experiments procedures and findings.

12. PARTICIPANT WITHDRAWAL

a) Describe how the participants will be informed of their right to withdraw from the project.

All participants will be informed of their right to withdraw through the informed consent process (please see attached letter of informed consent).

b) Explain any consequences for the participant of withdrawing from the study and indicate what will be done with the participant's data if they withdraw.

If a participant withdraws from the study prior to the research being submitted for assessment their data will be withdraw from the study (this is approximately 2 months after data collection). Any records of their data will be destroyed. Due to the small number of participants a high attrition rate may result in the study being terminated. The experimental phase of the study requires a minimum of one participant likewise, the evaluative phase of the study requires one participant. If participant numbers fall below the required level in the experimental phase the study will have to end. If the participant numbers fall below the required level in the evaluative phase this part of the study will not take place.

13. COMPENSATION

Will participants receive compensation for participation?

i) Financial

Yes ☐ **No** ☒

ii) Non-financial **Yes** ☐ **No** ☒

If **Yes** to **either** i) or ii) above, please provide details.

N/A

If participants choose to withdraw, how will you deal with compensation?

N/A

14. CONFIDENTIALITY

a) Will all participants be anonymous?
Yes ☐ No ☒

b) Will all data be treated as confidential? **Yes ☒ No ☐**

Note: Participants' identity/data will be confidential if an assigned ID code or number is used, but it will not be anonymous. Anonymous data cannot be traced back to an individual participant.

Describe the procedures to be used to ensure anonymity of participants and/or confidentiality of data both during the conduct of the research and in the release of its findings.

Due to the small sample size the researcher will be able to identify the students by a pseudonym. Therefore, the children's full names will not be used at any point during the data collection, analysis or write-up of the study. The researcher will have a record of the pseudonym and corresponding participant's name so that data can be withdrawn on request. Therefore, the data is confidential but not anonymous.

Participants in evaluative phase will be assigned numbers to protect their identity. Interviews will be assigned numbers at the point of transcription, these numbers will be referred to throughout data collection, analysis and write-up of the study. However, the researcher will keep a record of the participants name and corresponding number so that data can be withdrawn on request. Therefore, the data is confidential but not anonymous.

Names of participants will not be included in the studies write up, however other information such as their age, gender and information relating to their Special Educational Needs may be included. In addition, some broad information about the school will be included in the write up, such as the region it is in, the type of school and its OFSTED classification.

If participant anonymity or confidentiality is not appropriate to this research project, explain, providing details of how all participants will be advised of the fact that data will not be anonymous or confidential.

Child participants
Child participants will be informed, that their data is confidential. This information will be made accessible for participants who have additional needs, for example this may be explained verbally or through pictures.

The participants and the parents/guardians of child participants will also be informed that their data will not be shared with their peers and that their name will not appear in the final report. Furthermore, the name of the school or any information which could lead to its identification will not be included.

Adult participants

Adult participants will be informed, that their data is confidential through in informed consent process

15. STORAGE, ACCESS AND DISPOSAL OF DATA

Describe what research data will be stored, where, for what period of time, the measures that will be put in place to ensure security of the data, who will have access to the data, and the method and timing of disposal of the data.

All electronic data will be saved to using encrypted equipment provided by a local authority. This will then be transferred to an encrypted memory stick and stored at the University of Birmingham for 10 years in line with Birmingham University's research code of practice. The video will not be used beyond the research project.

Any data obtained in paper form (for example the completed observation schedules) will be stored in a locked filling cabinet in a local authority office for the duration of the study. This data will then be scanned into an electronic format and will be saved to an encrypted memory stick. This data will be kept for 10 years

16. OTHER APPROVALS REQUIRED? e.g. Criminal Records Bureau (CRB) checks or NHS R&D approvals.

☐ YES ☒ NO ☐ NOT APPLICABLE

If yes, please specify.

As the researcher will be working with children they will be required to have a valid DBS check- this has already been carried out by the University of Birmingham.

17. SIGNIFICANCE/BENEFITS

Outline the potential significance and/or benefits of the research

Benefits for participants: -Child participants will gain new functional skills -The setting in which the intervention is delivered will have a new means of teaching functional skills Benefits for researchers/practitioners: -Outline a procedure for immersive video modelling -Examine the effects that immersive video modelling has on anxiety/confidence- while this study will not be able to provide strong evidence that immersive video modelling reduces anxiety due to the nature of the sample (they do not experience elevated anxiety) and the nature of the anxiety measure (it is not a formal anxiety measure) it may provide early evidence that this intervention can reduce acute anxiety whilst teaching functional skills.

18. RISKS

a) Outline any potential risks to **INDIVIDUALS**, including research staff, research participants, other individuals not involved in the research and the measures that will be taken to minimise any risks and the procedures to be adopted in the event of mishap

Child participants

It is possible that some of the participants may find wearing the VR headset uncomfortable or distressing. Participants will be asked to wear a VR headset prior to the start of the study to ensure that they are comfortable in using the equipment. However, if at any point they start to indicate persistent discomfort or distress they will be withdrawn from the study.

Additionally, the manufacturer of the VR headset (Occulus) outline a number of potential risks associated with using VR headsets. Some of these risks can be mitigated through the delivery of the intervention. The table below describes these risks and how they researcher will reduce the likelihood that this risk will occur:

Risk	Response
Participants can fall or become disorientated while using the headset.	Participants will be seated throughout the study.
Facial injury	Participants will be asked to remove glasses before putting the headset on.
Disorientation after wearing the headset	Participants will be asked to remain seated following the intervention until the researcher feels that they have familiarised themselves with the environment.

There are also a number of potential side effects to using the VR headset. Information from the manufacturer states that 1 in 4000 uses can experience the following severe side effects: severe dizziness, seizures, epileptic seizures or blackouts triggered by light flashes or patterns. To reduce the likelihood of this risk individuals who have a history of seizures or epilepsy will not be asked to participate in the study. It is also possible that participants may experience the following less severe side effects: loss of awareness, eye strain, eye or muscle twitching, involuntary movements, altered, blurred, or double vision or other visual abnormalities, dizziness, disorientation, impaired balance, impaired hand-eye coordination, excessive sweating, increased salivation, nausea, lightheadedness, discomfort or pain in the head or eyes, drowsiness, fatigue, or any symptoms similar to motion sickness. Delivering the intervention will monitor the child during and after the intervention. If they demonstrate any of the side effects listed above (both severe or less severe) they will be withdrawn from the study. Parents will be informed, and appropriate medical action will be taken by the school's first aider.

It is possible that participants may find the baseline/assessment sessions distressing. If they become distressed during the baseline/assessment sessions they will be reassured by a member of school staff. If they remain distressed following this support they will be withdrawn from the study.

Adult participants/ adults overseeing the intervention

There are minimal risks posed to the adult overseeing the intervention. However, they may feel uncomfortable in delivering the intervention which may cause they some undue stress. To overcome this the researcher will provide training to any adult who wishes to oversee the intervention. They will also monitor the delivery of the intervention and provide regular guidance to staff. The researcher will also oversee a number of the sessions to support the member of staff in their delivery.

As some assessment sessions may require the staff to leave the school site with pupils there are a number of risks that must be considered as part of the schools policy. The researcher will ensure that an appropriate risk assessment has been carried out prior to visits away from the school site to protect staff, children and members of the public.

b) Outline any potential risks to **THE ENVIRONMENT and/or SOCIETY** and the measures that will be taken to <u>minimise</u> any risks and the procedures to be adopted in the event of mishap.

I do not anticipate any environmental or societal risks arising in this study.

19. ARE THERE ANY OTHER ETHICAL ISSUES RAISED BY THE RESEARCH?

Yes ☒ **No** ☐

If yes, please specify

Un-due anxiety- As part of this study aims to assess anxiety levels it is possible that the study may produce undue anxiety in participants. The following steps have been taken to address this:

-Ensuring that skills taught to participants are 'every day activities'- the skills selected for the intervention will be deemed reasonable and necessary skills for independent life.
-Participants who are known to experience high levels of anxiety will not be selected for the study. If parents or school staff report that the child demonstrates high levels of anxiety they will not be selected for the study. Likewise, if the child has had any previous involvement with Child and Adolescent Mental Health Services they will not be selected for the study.
-Any participant who appears to be experiencing high levels of anxiety/appears distressed by the study will be withdrawn.

Use of mobile phone to play video clips in VR headset- As the device is a mobile phone, notifications containing confidential information may pop up on the screen. Likewise, the child may try to access the phone. to address this the following steps will be taken

-The phone will be locked into the headset so the participant will be unable to remove it. Sellotape will be used to cover the locking panel to further reduce the likelihood the participant will be remove the phone. Additionally the participant will also be observed throughout the intervention sessions.
-The phone will be placed into aeroplane mode and notifications will be turned off to prevent any notifications appearing on the screen while the participant is watching the video.

20. EXPERT REVIEWER/OPINION

You may be asked to nominate an expert reviewer for certain types of project, including those of an interventional nature or those involving significant risks. If you anticipate that this may apply to your work and you would like to nominate an expert reviewer at this stage, please provide details below.

Name
Contact details (including email address)
Brief explanation of reasons for nominating and/or nominee's suitability

21. CHECKLIST

Please mark if the study involves any of the following:

- Vulnerable groups, such as children and young people aged under 18 years, those with learning disability, or cognitive impairments ☒
- Research that induces or results in or causes anxiety, stress, pain or physical discomfort, or poses a risk of harm to participants (which is more than is expected from everyday life) ☐
- Risk to the personal safety of the researcher ☐
- Deception or research that is conducted without full and informed consent of the participants at time study is carried out ☐
- Administration of a chemical agent or vaccines or other substances (including vitamins or food substances) to human participants. ☐
- Production and/or use of genetically modified plants or microbes ☐
- Results that may have an adverse impact on the environment or food safety ☐
- Results that may be used to develop chemical or biological weapons ☐

Please check that the following documents are attached to your application.

	ATTACHED	NOT APPLICABLE
Recruitment advertisement	☐	☒
Participant information sheet	☒	☐
Consent form	☒	☐
Questionnaire	☐	☒
Interview Schedule	☒	☐

22. DECLARATION BY APPLICANTS

I submit this application on the basis that the information it contains is confidential and will be used by the

University of Birmingham for the purposes of ethical review and monitoring of the research project described

herein, and to satisfy reporting requirements to regulatory bodies. The information will not be used for any

other purpose without my prior consent.

I declare that:

- The information in this form together with any accompanying information is complete and correct to the best of my knowledge and belief and I take full responsibility for it.
- I undertake to abide by University Code of Practice for Research (http://www.as.bham.ac.uk/legislation/docs/COP_Research.pdf) alongside any other relevant professional bodies' codes of conduct and/or ethical guidelines.
- I will report any changes affecting the ethical aspects of the project to the University of Birmingham Research Ethics Officer.
- I will report any adverse or unforeseen events which occur to the relevant Ethics Committee via the University of Birmingham Research Ethics Officer.

Name of principal investigator/project supervisor:	
Date:	

Please now save your completed form, print a copy for your records, and then email a copy to the Research Ethics Officer, at aer-ethics@contacts.bham.ac.uk. As noted above, please do not submit a paper copy.

Appendix 22- Final report to school

Research Report

Project title: Immersive Video Modelling: A Mixed Methods Evaluation of an intervention to teach functional skills to children in a specialist secondary setting

About the Researcher

My name is Daniel Hawkins and I am a studying for a Doctorate in Applied Educational and Child Psychology at The University of Birmingham. As part of this course I get the opportunity to complete a piece of research in an area of interest. This research project was completed as part of my study whilst I was on placement with the Educational Psychology Service.

The Project

During the Spring Term 2019 I worked alongside staff in class 9b to set up and deliver a new intervention called immersive video modelling (IVM). The aim of the project was to determine the efficacy of IVM and gather staff views of the approach. A summary of the findings of this intervention are contained within this report.

What is Immersive Video Modelling (IVM)

IVM is an intervention that uses 360 degree video and head mounted displays to present children with videos that show a person carrying out a skill. The key idea of this intervention is that children are able to learn the skill through watching the 360 degree video. There is good evidence to show that children are able to learn skills though watching videos (Shukla-Mehta, Miller and Callahan, 2010). There is also an emerging evidence base for the use of virtual reality to teach skills to children (Jensen and Konradsen, 2017). IVM is a combination of these two ideas and therefore there is a evidence base to suggest that it could be an effective intervention.

What happened during the project?

First, children and their parents were invited to an introductory session in which the approach was explained and the technology was introduced. Parents and children were asked if they wanted to participate. Some children chose not to wear the headset while others were not able to take part in the study on medical grounds. These children were not officially part of the study, however they were still given the opportunity to learn a skill though video. Six children took part in the research

project. Parental consent was obtained for all children who worked with the Trainee Educational Psychologist (including those who did not wear the headset).

Children, staff and parents were asked to think about skills they wanted to learn though watching the videos. Through these discussions it was decided that a number of the children wanted to learn to tie shoelaces. A task analysis was completed for this skill and a number of specialist approaches were used to tie the laces including the use of thick laces, different coloured laces and a specialised tying technique. A 360 video was made for this skill using a Samsung Gear 360 camera.

Before the study started, children were asked to complete the skill a number of times without instruction. This was done to determine what the children already know and to make sure that they were unable to complete the skill in full prior to instruction. This provided a baseline of the children's skills.

After a baseline was obtained children were asked to watch the video before trying to carry out the skill. Videos were presented though a mobile phone (Samsung Galaxy S6) placed inside a head mounted display (Samsung Gear VR). Children were asked to watch the video and practice the skill twice per day. Children's performance during this task was measured through using an observation schedule. Children were asked to carry on completing these sessions until they mastered the skill or until they failed to make any progress during three consecutive sessions. This discontinue criteria was set to prevent children from becoming disheartened during the intervention.

Children who mastered the skill were then revisited two weeks later to assess if they had maintained this skill over time. Likewise, they were also assessed to see if they could use the skill in different settings. Furthermore, after the final intervention sessions interviews were carried out with the staff in 9b. The purpose of these interviews was to gain an a more in-depth understanding regarding the use application of IVM.

Ethical Considerations

A number of ethical considerations were made to protect the participant's during this study including anonymity, right to withdraw, fully informed consent and the mitigation of any risks associated with the use of the technology. This study had full approval from the University of Birmingham Ethics Committee.

Findings

The findings of the IVM intervention were mixed. One child was able to master the skill within four intervention sessions. They were also able to maintain and generalise this skill to new settings. However, the other five children were not able to master the skill. One child showed progress in shoe-lace tying while the other three showed limited progress from the baseline measure. Overall, these findings suggest that the intervention can be effective, however it was not clear from this study why IVM was only effective for one child. More research is required to be able determine the factors that influence the success of IVM.

Interviews with staff highlighted a number of interesting points. Overall, attitudes towards the use of IVM were positive and they seemed enthusiastic to use the approach. Staff noted that the use of the headsets allowed children to become more focussed on the videos during the intervention after they had become used to wearing them. However, Staff also noted that the way that the skill was taught was possibly more complicated than a traditional method and it may have been more suitable to build on the child's existing knowledge rather than teaching them an entirely new approach, it is possible that this impacted on the children's ability to learn the skill.

Conclusions

The results of this study provide some evidence to show that IVM is a viable intervention, however it is clear that this intervention does not work for everyone in its current format. Staff interviews provided useful feedback regarding the way the intervention is designed, and it appears that building on the students existing knowledge may be a better way of structuring the intervention in future research.

While the use of 360 degree video is not common in schools yet, this study demonstrates that it can be applied in a specialist setting and children can engage with the video format. The use of head mounted displays appears to offer some unique benefits including increased presence (i.e. feeling like you are in the video), increased motivation and increased concentration. These benefits may be of use to educators moving forwards.

Staff noted that using 360 video may be a useful way of allowing children to experience new environments without having to leave the classroom. This was thought to be especially useful for children who were nervous about vising a new place as it would give the chance to see what the environment was like before going. This technology was used in this way following this intervention to help children who were worried about an upcoming residential trip. Children reported that being able to see 360 photos of the grounds and rooms they would visit reduced their anxiety about aspects of the trip. This suggests that a major benefit of 360 degree video is that it allows teachers to bring the community into the classroom and it overcomes a number of practical barriers that prevents access to the community (such as staffing, travel and safety considerations).

What Next

This is an abridged report that covers the key findings of this research. The full research report is currently being written into a thesis as part of my studies. It should be published on the Birmingham e-thesis website towards the end of 2019. If you wish to request a copy of this when it is published you can email the [redacted] Educational Psychology service to request a copy: eps@.gov.uk.

Acknowledgments and Thanks

Firstly, I would like to thank Mr Headteacher for his interest in the research project and allowing me to carryout my research at High School. I would also like to thank all of the staff and students at school for being so welcoming.

I would also like to extend a massive thank you to Mrs X, Miss Y and Miss Z for their time, commitment and everything they did to make this project possible. Their knowledge and professionalism enhanced the quality of the project immensely. I thoroughly enjoyed spending time in their classroom and it was a privilege to be made to feel so welcome.

Finally, I would like to offer my biggest thanks to the children of class 9b and their parents, without whom the study would not have been possible. The students worked incredibly hard throughout the project and showed masses of concentration and determination. It was a pleasure to be able to get to know them and hear about their successes in school and during their residential trip. I wish you all the best of luck for the future.