THE ROLE OF MINECRAFT ON SOCIAL-EMOTIONAL AND BEHAVIOURAL OUTCOMES OF CHILDREN WITH HEARING LOSS OR AUTISM: PERSPECTIVES OF PARENTS AND CHILDREN

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DECLARATION OF AUTHENTICITY AND AUTHOR RIGHTS

This thesis is the result of the author's original research. It has been composed by the author and has not been previously submitted for examination that has led to the award of a degree.

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ABSTRACT

Children with Autism Spectrum Disorder (ASD) or Hearing Loss (HL) have relationship challenges and mental health difficulties due to functional disturbance affecting social interaction. This study examined the role of Online Computer Game (OCG), and specifically Minecraft (MC), to facilitate social relations, mental health, and the well-being of children with ASD and/or HL in the United Kingdom (UK) and the Kingdom of Saudi Arabia (KSA).

MC is a sandbox computer game in open-world format and recognised to be socially interactive gameplay, chosen here due to its popularity, accessibility and cooperative gameplay characteristics. In the first phase of this research, a systematic literature review was conducted of all peer-reviewed articles that were written in English and included first-hand evidence to synthesise the evidence for and against MC use in education (n=38). The review concluded MC to be beneficial to children regarding increased motivation for academic learning and social development including communication, sharing and collaboration skills. Therefore, the second phase was conducted to identify correlations between playing OCG or MC and children's social-emotional and behavioural outcomes, and specifically players' peer relationship problems using the convergent mixed methods design approach. Data consisted of three parts: questionnaire (n=255), interviews (n=7) and observations (n=4). Subjects for the questionnaire were parents of primary school children aged 8 and over from three groups: children with ASD (n=121), children with HL (n=11) and Typical Developing (TD) children (n=123).

This thesis reported that MC is a social or entertaining activity that can be used as a place for social intervention for three reasons. First, cooperative gameplay on MC has no significant associations with difficulties on the SDQ for either TD or children with ASD in this research sample. Secondly, higher frequency of playing MC with others is associated with a lower peer relationship problems score in the KSA sample. Thirdly, the qualitative pieces of evidence show that the benefits outweigh the risks of playing MC, notably for children with ASD or HL. Therefore, MC might be potentially

beneficial for social intervention for children with ASD or HL. Parents reported three main reasons for being interested in MC for children with ASD or HL: peer relationships and peer support (i.e., a space for social interaction with others), emotional benefits (e.g., enjoyment and being happy) and behaviour benefits (i.e., being calm and relaxed or as a reward for desirable behaviours). Concerns about addiction, safety, and physical activity use were raised, but evidence shows that most of these concerns are related to gaming management rather than MC itself as a game. Concerns and thesis' limitations are discussed.

Altogether, these data suggest that MC game-play may be considered appropriate for social interventions for children with ASD or HL, and may be considered for incorporation into educational pedagogy or psychological support for its social benefits. The study significantly added understanding of gaming and diagnostic condition characteristics in the role of peer relationship skills among children. The findings may help to advance current literature in the areas of children's social-emotional and behavioural development.

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ABBREVIATIONS

AQ	Autism Spectrum Quotient
AS	Asperger Syndrome
ASD	Autism Spectrum Disorder
DHH	Deaf and Hard of Hearing
HFA	High-Functioning Autism
HL	Hearing Loss
KSA	The Kingdom of Saudi Arabia
MC	Minecraft
OCG	Online Computer Games
PDD	Pervasive Developmental Disorders
SDQ	Strength and Difficulties Questionnaire
SPSS	Statistical Package for the Social Sciences
TD	Typical Developing Children
UK	The United Kingdom
US	The United States of America
VLE	Virtual Learning Environments
VR	Virtual Reality

CHAPTER 1: INTRODUCTION

This thesis utilizes a mixed method study to identify correlations between the playing of Online Computer Game (OCG), specifically Minecraft (MC), and children's social-emotional and behavioural outcomes, especially players' peer relationships, using a sample of children with special needs from the United Kingdom (UK) and Kingdom of Saudi Arabia (KSA). It seeks to explore whether OCG or MC has a role in children's social-emotional and behavioural outcomes. This is important as it can contribute to the educational pedagogy or psychological support for children. Thus, the study aimed to enhance the understanding of gaming and its role in peer relationship skills among children. This chapter introduces the topic and key information that is necessary for such an investigation. This information includes the essential main research points to be explored and is intended to guide readers from a general overview of the discipline area to the particular topic of inquiry, this being important to establish the project's scope, context and the significance of the research.

1.1 Background of the Study

In this section, I mainly identify the two key conditions that are important to be clarified for the research, namely Autism Spectrum Disorder (ASD) and Hearing Loss (HL). In this thesis, the term 'children' is used occasionally and refers to any person aged 18 or less. According to the Children and Young People (Scotland) Act 2014: National Guidance on Part 12, (p.2), "The term 'child' or 'children' refers to persons who have not yet attained the age of 18 years as stated in section 97(1) of the 2014 Act". Parents and children with ASD or HL may have an individual preference about how to call their condition. Thus, the term "a person with autism" is mostly acceptable by individuals with autism, their friends and professionals (Kelley, 2014; Kenny et al., 2015); and, therefore, the term "a person with ASD or HL" has been used in this study for the same reason and to avoid emotional consequences.

1.1.1 Autism Spectrum Disorder (ASD)

ASD is a neurodevelopmental disorder that affects an individual's social development skills and communication skills. Before 2013, professionals had used a previous manual, called the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition (DSM-IV), that was published by the American Psychiatric Association. In the DSM-IV, there are multiple Diagnostic Classifications, but the two main ones relevant to this thesis are the Autistic Disorder and the Asperger's Disorder. The main features of Autistic Disorder are the presence of particularly abnormal or impaired development in social interaction and communication, as well as a restricted repertoire of activity and interest, though these symptoms differ based on the child's developmental level and chronological age (American Psychiatric Association, 2000). Autistic Disorder has two main categories, high-functioning autism (HFA) where children have average or above average cognitive abilities on the Intelligence quotient (i.e., IQ ≥ 70), and low-functioning autism (LFA) which is used to identify autistic children with cognitive impairments. Furthermore, in an early version of the DSM-IV, Asperger Syndrome (AS) was differentiated from the Autistic Disorder, where children diagnosed with AS have no significant clinical delays in language, adaptive behaviour, cognitive development, self-help skills, or curiosity about the environment in their childhood (Ozonoff, Rogers & Pennington, 1991; Sahyoun et al., 2009; South, Ozonoff & McMahon, 2005; Thede & Coolidge, 2007).

However, after 2013, a new Diagnostic and Statistical Manual of Mental Disorders (DSM-5) was published where the diagnosis of ASD is called Autism Spectrum Disorder (ASD) and with the sub-groupings no longer being used (Autistic Disorder, Asperger Syndrome, Pervasive Developmental Disorder). Symptoms in the DSM-IV were divided into three aspects (impairment in social interaction, in communication, restricted and repetitive behaviours), the same two categories as the DSM-5; however, the DSM-5 criteria were rearranged into two main areas: 1) social communication/interaction, and 2) restricted and repetitive behaviours. According to the DSM-5, the diagnostic criteria for ASD include: "Persistent deficits in social communication and social interaction across multiple contexts"; "restricted,

repetitive patterns of behaviour, interests, or activities"; "symptoms must be present in the early developmental period"; "symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning"; and "these disturbances are not better explained by intellectual disability […] or global developmental delay" (American Psychiatric Association, 2013, pp.50-51).

Another key diagnostic manual is provided by the World Health Organization and is used most commonly in the UK. This diagnostic manual is the International Classification of Diseases, tenth edition (ICD-10), which provides some possible autism profiles under the Pervasive Developmental Disorders (PDD) heading, such as childhood autism and Asperger Syndrome (World Health Organization, 1992). In the most recent edition of the ICD-11, ASD was described into the same two categories of the DSM-5 - difficulties in initiating and sustaining social communication as well as in social interaction, and restricted interests and repetitive behaviours (World Health Organization, 2018). This edition (ICD-11) collapses autism, AS, PDD, and PDD-NOS into a single diagnosis of 'autism spectrum disorder', similar to DSM-5. However, the guidelines for differentiating between ASD with and without intellectual disability were provided by ICD-11, whereas the DSM-5 only acknowledges that ASD and intellectual disability can co-occur.

As a result of all previously mentioned symptoms, individuals with ASD have different styles of paying attention, responding to things or learning. It initiates during early childhood and almost usually remains throughout the individual's life. There is currently no cure for ASD. The above symptoms imply that it is a disorder that should not be overlooked.

The reported conditions of ASD, especially in children, have increased tremendously over the last few years. According to the Centre for Disease Control and Prevention, the number of people recognised as having ASD has been increasing. The rate of people with ASD was 1:150 in 2002; 1:125 in 2004; 1:110 in 2006; and 1:88 in 2008, while in 2010 there was at least one case of ASD in every 68 people in the United States (Data & Statistics, 2015). The proportion of ASD among the genders is 1:42 for males and 1:189 for females (Data & Statistics, 2015). In England, according to Brugha

et al. (2009), 1.8% of males and 0.2% of females (1.0% of both genders) were diagnosed with ASD in 2007. MacKay, Boyle and Connolly (2016) presented a systematic review and meta-analysis of all English and peer-reviewed papers that have mentioned ASD prevalence since 2002 and proposed that the most reliable ASD prevalence estimate at present is 1.04%.

In terms of the cultural context of this investigation, the estimated prevalence of ASD is 1% in the UK (Baron-Cohen et al., 2009). In Northern Ireland, the prevalence rate of children with ASD at school age (4-15 years old) in 2017-2018, increased to 4.5% of males and 1.2% of females (2.9% of both genders) (Waugh, 2018). The recent prevalence of ASD in Scotland "is not known", as the last "potential data source is the Scottish Census 2011" (MacKay et al., 2017, p.45) stated it is about 1.1% (p.9).

According to the General Authority for Statistics in KSA (2017), the estimated percentage of Saudis who have difficulties in communication and understanding of others is 0.011 (226,510/ 20,408,362) in 2017; however, this did not specify ASD, and this percentage may include children with other developmental difficulties, as no official percentage of ASD has been published yet. Another estimated prevalence of ASD in KSA is 0.0018% (Al-Salehi, Al-Hifthy & Ghaziuddin, 2009). In one Saudi district, Taif, ASD prevalence of children aged between 7 and 12 years was reported as 0.035% (Al-Zahrani, 2013), but Naqvi (2012) estimated the prevalence of children with ASD in KSA as a whole as 0.6%. However, accurate estimation is not available because services have not been well developed (Alnemary, 2017; Qureshi et al., 2001). Anecdotal information proposes there has been an increase in the prevalence of ASD in KSA (Al-Zahrani, 2013; Bindawas & Vennu, 2018; Daghustani, 2017). Mashat, Wald and Parsons (2014) concluded that services for children with ASD were very limited, and there is a lack of support for adults with ASD in KSA, as only three centres actually accept adults with ASD in the whole country, and in fact the age limit for services for two of them is set as 14 and 16 respectively. This number puts pressure on families, societies and the government to meet those individuals' needs (Alnemary, 2017); thus, this issue needs to be thoroughly studied.

ASD is a spectrum; thus, children with ASD may be very different from each other. However, all of them have social and communication difficulties that impact their daily life to such an extent as to be officially diagnosed with ASD. The greatest social concern at school is being accepted by other students in the classroom and having friends (Chilvers, 2007). Furthermore, it is also important to remember that most children with ASD only have a normal Intelligence Quotient (IQ), but some of them have comorbidity of ASD and intellectual disability where IQ becomes an issue. It is essential for the needs of children with ASD in schools to be discussed.

There are many problems that children with ASD may have in school that might arise from their social and relationship difficulties. According to Baron-Cohen and Bolton (1993), the central warning sign for ASD is the inability to relate socially to other people. Classrooms may have a variety of environments that are difficult for children with ASD, especially when there is loud noise or difficult social language (Chilvers, 2007). Children with ASD may be interpreted as misbehaving due to their low level of understanding of social rules and their inability to follow hidden instruction, which children without disabilities learn unintentionally (Chilvers, 2007), which will have an adverse impact on their relationships with others. Being social in the classroom with peers and developing positive relationships are critical for developing a suitable environment for learning, as well as fostering better mental health. Educational institutions need to recognise the importance of the social world as it shapes the future for the child, and as the goal of learning is to develop students for the future (Dewey, 1960, 2004).

Children with ASD face many social difficulties every day. The most common problems, quoted from Baron-Cohen and Bolton (1993, pp.41-42), are "unresponsiveness to people, lack of attention to people, treating parts of people as detached objects, lack of eye contact, treating people as if they were inanimate objects, lack of behaviour appropriate to cultural norms, attention to the non-social aspects of people, lack of awareness of the feeling of others, and lack of savoir-faire". It can be noted that most of these difficulties are related to social and communication skills. Furthermore, Jamison and Schuttler (2015) examined the similarities and

differences of the social competence, self-perception, quality of life, and problematic behaviours for adolescent females with ASD, without ASD. The results showed that females with ASD rated themselves significantly lower in social competence, self-perception, and quality of life than females without ASD. Higher levels of internalising and externalising symptoms were reported by females with ASD than TD females. Hence, children with ASD face more social difficulties than children without it. Thus, interventions for developing social skills and improving the quality of life and well-being of these children are needed. However, social skills cannot be learned perfectly while isolating the self from others. Social skills are developed by social interaction, which becomes very effective when associated with having relationships. Thus, the scope of this investigation is the relationship skills and their association with OCG.

1.1.2 Hearing Loss (HL)

There are some different terminologies to express this condition, such as deafness or HL. HL is used here, as it is the term most frequently used in the UK and KSA literature. Some children are born with a degree of HL or it develops gradually, but others may occur suddenly. Notably, the area of HL should be located first, and there are two main types related to the hearing sides: 1) monaural HL (unilateral, on one side); and 2) binaural HL (for both ears, both ears may require hearing aids) (Gelfand, 2017). Secondly, there are two main types of HL, which are conductive and sensorineural, or a mixture of the two types. Conductive HL is due to the deficits in the sound-conducting apparatus of the outer and middle ear, due to some problems such as fluid in the middle ear, infections, a solidity of the middle ear bones preventing the three small bones in the middle ear from vibrating, or a hole in the eardrum (Eggermont, 2017). The treatment of this can be undertaken with the decision based on the causes, which may include using hearing aids or surgery, such as middle ear or bone conduction implants (Isaacson & Vora, 2003). The other type of HL is sensorineural, an obstruction in the outer or middle ear, which can be a result of damage to the hair cells in the inner ear (Eggermont, 2017). The treatment for this can be undertaken depending on the severity, for example through hearing aids or cochlear implants, which are used more commonly for severe sensorineural HL

(Eggermont, 2017). In addition, one of the types of HL is the central HL (some publications call it the Neural HL), which can be a result of a head injury or disease that caused difficulties with the auditory nerve or sound centres being able to send the electrical impulses to the brain completely or precisely (Eggermont, 2017; Gelfand, 2017). Understanding those different types of HL would contribute better to the hearing aids or the intervention provided by the schools.

HL is a condition that has been used by some research to describe the state of having some degree of hearing deficit measured in decibels (dB), which measure sound intensity or loudness. Children without HL can hear sounds between 10 and 25 dB; children with mild HL can hear sounds between 26 and 40 dB, with moderate HL the range is 41 to 55, for moderately severe it is 56 to 70, severe is 71 to 90, and for profound it is over 90 dB (Gallaudet Research Institute, 2011). According to the Gallaudet Research Institute (2011), almost 40% of students with HL have a severe or profound degree of it. Furthermore, Dalton (2011) estimated the percentage of students with mild and moderate HL in integrated population as high as 15%.

According to the Scottish Council on Deafness (SCoD, n.d.), 75 children are born deaf in Scotland every year, and five of them have severe to profound HL. Furthermore, 840 are born deaf in the UK as a whole (i.e., 1 in every 1,000 children), and the total number of children and adults under the age of 25 with HL are 34,800 and 3000 in the UK and Scotland specifically, respectively (SCoD Statistics, n.d.). In KSA, similar to ASD prevalence, there is also no official number of people with HL, but according to the General Authority for Statistics in the KSA (2017), the estimated percentage of Saudis who have hearing difficulties was 0.014 in 2017; however, this did not specify HL as a 'disability', and this percentage may include people with other temporary hearing difficulties. The only available official percentage is for people who are using sign language, which is 0.0013% of the Saudi population. The World Federation of the Deaf officially estimated that there were 100,000 deaf and hard of hearing people in KSA in 2008 out of the total population 22,570,580 (0.0044%) (WFD, 2008). This may indicate that the number of people with HL has decreased in the KSA recently.

Children with HL confront many friendship and social difficulties due to their communication difficulties, which seems to be the greatest barrier for deaf students to establish relationships with hearing peers (Antia & Kreimeyer, 1997; Harris, 2000; Most, 2007). Furthermore, Hoffman, Quittner and Cejas (2015) noted that children with HL had a significantly lower language level compared to children in the hearing group. Language development is found to be a core element for developing social skills, and students with HL are considered at risk of low social relationship skills because of their language deficits (Luckner, Slike & Johnson, 2012). It has been estimated that 1 in 2,700 children are born with HL worldwide and that 95% of these are born into hearing families (Hindley, 2005), which indicates a sense of isolation in the home as well. Students with mild and moderate HL need to have a sense of belonging and connection, and therefore teachers should provide ongoing support and encourage students' interactions. HL can influence students' social, cultural, psychological and medical development (Hindley, 2005).

The biggest problem in teaching students with HL is communication because it is impacted by many factors, such as early diagnosis, parental communication attitudes, and home communication mode. Antia et al. (2011) did a five-year longitudinal study that aimed to examine the social outcomes of students with hearing impairment [a term that is no longer used and was replaced by HL] who attend general education classrooms, and provided a literature review of the social outcomes of students with HL. The researchers inferred that children with HL have poor social relationships and communication skills, which may prevent them from developing adequate social skills or relationships. Communication abilities of students with HL were the most common factors that contributed to their social condition or outcomes. These social outcomes might be due to the fact that some children with HL are taught in special classes. Indeed, according to Gallaudet Research Institute (2011), 32.2% of students with HL in US schools were not integrated with students with normal hearing, while 8.9% spend five hours or less per week with students with normal hearing. Having no contact or little contact with students without HL would create a significant social and emotional gap.

A great number of studies have investigated the social and emotional development of students with HL. Children with HL seem to be more subject to mental health problems; the prevalence of mental health problems among people with HL is estimated to be 1.5 to 2 times more than in hearing people (Hindley, 2005), and 40% of people with HL have experienced mental health problems (SCoD Statistics, n.d.). Loneliness is a common mental health issue among children with HL and can have an adverse impact on children's mental health. An early study of social interaction among children with HL showed more internalising of problems, such as depression, anxiety, and low self-esteem, as well as having negative emotion due to isolation from peers. Children who are less likely to interact with others were less accepted and liked by their peers (Strauss, Forehand, Smith & Frame, 1986). Also, Theunissen et al. (2011) noted that people with HL showed significantly more symptoms of depression than hearing peers, and students with HL, who attend special schools or use sign language only, may feel more isolated because they have less interaction with hearing peers. Likewise, students who wear hearing aids tend to have negative self-esteem due to the adverse attitudes of others (Polat, 2003). Furthermore, children with hearing loss with no hearing aids have significantly greater depression than children with hearing loss and hearing aids; and both groups have significantly greater depressive symptoms than the group without hearing loss (Goorabi, Hosseinabadi, & Share, 2008). Therefore, social interaction is important for developing social relationships with others as well as reducing mental health problems and maintaining desired well-being.

A cochlear implant, which replaces the function of the impaired inner ear, is not enough for developing peer relationships and improving mental health for students with HL (Yi & Kim, 2015). Bat-Chava and Deignan (2001) interviewed parents of children with cochlear implants to understand their children's peer relationships before and after the implant. The results show that 28% of parents reported improvements in peer relationships without limitation while 56% stated a mixture of development and limitations, and 16% of parents reported limitations only. Thus, the cochlear implants are not a guarantee for the development of peer relationships, and

even if children with HL have a cochlear implant, they still need to be supported in terms of their social and relationship skills with peers. Therefore, OCG might be a supportive tool for developing social and communication skills for students with HL.

Children with HL and an additional disability may have greater deficits in their social and academic skills. McCain and Antia (2005) conducted a comparison study with 28 participants in a co-enrolled classroom to investigate the academic, communication, and social performances of students with HL. Children with HL and an additional disability showed more challenges in interactions with peers even with an only mild additional disability, and their teachers rated them with a lower degree of social skills. Students with an additional disability had passive opinions about their classroom, and they were less interested in communicating with their peers (McCain & Antia, 2005). In the next section, the state of children with both HL and ASD will be discussed.

In summary, HL children should have exposure to communication, and be immersed in the community in order to reduce the possible struggle of age-appropriate social skills and theory of mind. Technology devices, such as hearing aids and cochlear implants, have helped people with HL to move toward the hearing world (Batten, Oakes & Alexander, 2014). Better social skills would help children to develop well psychologically and protect them against life challenges and stress, but rejection by peers would increase the educational and psychological challenges for deaf children (Batten et al., 2014). Children with HL are subjected to emotional difficulties due to peer rejection and the low quantity and quality of hearing peers' friendships or relationships (Batten et al., 2014; Yi & Kim, 2015).

1.1.3 Comorbidity of ASD and HL

Children with comorbidity of ASD and HL experience many issues with the diagnosis. No standardised psychometric assessments have been validated for diagnosing children with comorbidity of ASD and HL, although there are some screening tools. For example, The Autism Diagnostic Observation Schedule-Generic (ADOS-G) is sometimes used for assessing individuals with hearing issues, but its guidelines state that it is not endorsed to be used for children with HL (Meinzen-Derr et al., 2014). An

estimated 30–40% of students with HL may present with an additional disability (Punch, n.d.; Meinzen-Derr et al., 2014). The prevalence of children with HL who have ASD is 3.5%, which is at least 10 times the prevalence of children with HL from the general population (Rosenhall et al., 1999). Also, Fitzpatrick et al. (2014) investigated the prevalence of ASD in children with permanent HL in a Canadian region and reported that 2.2% of children with HL have a diagnosis of ASD as well; this is two times greater than the percentage of children with ASD only. In the USA, 1.7% of students with HL have been diagnosed with ASD (Gallaudet Research Institute, 2011).

Children with HL tend to have difficulties with spoken language. This may impact their abilities to share information, such as expressing emotions or feelings or responding to names, which may impact their diagnosis of ASD. Children with these two conditions simultaneously tend to be diagnosed with HL before ASD due to the previously mentioned reason. Studies have shown that the diagnosis of ASD is usually made after the cochlear implant for most of the children who have both conditions (Meinzen-Derr et al., 2014). Individuals with ASD and HL received the diagnosis of ASD at an average age of 5.5 years (Meinzen-Derr et al., 2014), whereas children with ASD alone tend to receive the diagnosis at the age of 3.1 years (Mandell, Novak & Zubritsky, 2005). This delay in diagnosis makes the situation worse for the child's social and academic life, as early intervention tends to be more effective. Therefore, children with both diagnoses are more likely to have more significant social and communicative difficulties (Stoddart, McColl, Lowe & Temple, 2003).

1.2 The Need for Study/ Problem Statement

As has been shown above, children with ASD and/or HL have difficulties in developing social relationships (Antia et al., 2011; Baron-Cohen & Bolton, 1993; Batten et al., 2014; Bertilsdotter-Rosqvist, Brownlow & O'Dell, 2015; Chilvers, 2007; Luckner et al., 2012), and they may receive different interventions for developing relationships or friendships with others. However, most of these interventions are mainly placed in schools, so once children leave school, they tend to lose these skills gradually or might not be convenient for children with ASD (Ringland, 2019). On the other hand, when

they develop a safe relationship through an online tool, this relationship might be easily maintained and fostered within and outside schools. Thus, this investigation sought to discover whether OCG and MC specifically, can be used for this purpose in maintaining relationships. Secondly, many studies find children with ASD and HL have greater mental health problems, such as emotional difficulties due to the impact of the disability (Brown & Cornes, 2015; Hindley, 2005; Ghaziuddin, 2005). Thus, this thesis investigates the association between Minecraft and children's mental health problems. This is important because the better mental health a person has, the better the welfare they will have.

Children need to develop their relationship skills, which can be the foundation for developing social and communication skills (Bagwell, 2004; Reitz et al., 2014; Luckner & Movahedazarhouligh, 2019; Strauss et al., 1986). Studies have found that it is easier to develop such a skill in childhood than in adulthood (Reitz et al., 2014; Sherman, De Vries & Lansford, 2000), as people become more independent in adulthood (Berndt & McCandless, 2009; Ferrer & Fugate, 2014; Newcomb & Bagwell, 1995) and because the needs of friendships become more insistent when children become teenagers and young adults (Chilvers, 2007). Difficulties in making friends can increase the risk of various negative psychosocial outcomes (Newcomb, Bukowski & Pattee, 1993). Peer relationship problems are associated with greater risk of developing learning difficulties (Wentzel & Asher, 1995). These difficulties may result in challenges in education, social and vocational life, as well as dating skills; however, this period is not included in this research, as I focus on late childhood. Thus, this study is critical because it aims to provide a better understanding of the impact of OCG, mainly MC, on children's social-emotional and behavioural outcomes, including peer relationship skills, as these are imperative for children's independence, vocational life, and well-being (Frey, Fisher, & Smith, 2019).

Both variables, having better relationship skills and fewer mental health problems, are important for all children, and in particular for students with ASD or HL. These variables are strongly linked to each other because mental health status has a major impact on relationship skills and vice versa (Kawachi & Berkman, 2001). For example,

children who show prosocial behaviour tend to be more attractive, socially successful. Also, children with anxiety or depression tend to show less interest in forming relationships with others (Zahn-Waxler, Klimes-Dougan & Slattery, 2000).

On the other hand, OCG may have some advantages in children's social-emotional and behavioural outcomes (Hedges et al., 2018; Paus-Hasebrink, Kulterer, & Sinner, 2019; Tsikinas & Xinogalos, 2019). Educationalists and psychologists have studied the relationship between digital learning and OCG, which are noted to be in line with learning theories, according to the behaviourists' philosophy, social cognitive theory, Information processing theory, George Herbert Mead's thoughts on play, and Vygotsky's Zone of Proximal Development (Egenfeldt-Nielsen et al., 2013; Wardlow, 2014). Connolly, Boyle, MacArthur, Hainey and Boyle (2012) conducted a systematic review of the impact of computer games on teenagers and concluded that computer games are associated with cognitive, behavioural, affective and motivational impacts and outcomes. Indeed, OCG not only has benefits for social and academic skills, but also can be supportive in developing motor, cognitive, spatial, and emotional skills such as self-esteem and self-confidence (Felicia, 2009) as well as being stress relieving (Wack & Tantleff-Dunn, 2009). There are a variety of emotions that OCG players may experience, such as "joy, empathy, anger, frustration or triumph", which develop players' learning, "especially if the emotional content or tone of the material to be learned matches the emotions of the learner" (Felicia, 2009, pp.8-9). Also, children with disabilities are given a chance to experiment with different situations and events in life as well as possible identities through online avatars. Therefore, digital learning and OCG teach a player to discover about themselves as learners and experience the subject while embedded in the cultural environment (Mitgutsch, 2008).

Minecraft (MC) is a sandbox computer game with a three-dimensional environment that allows players to break and place blocks as a single player or as a multiplayer. It can be played on a PC or Mac computer and on any tablet device. MC is 'the second highest-selling videogame of all time' (Karsenti & Bugmann, 2018, p.197), and it is a unique computer game that has no limits to its use. It was designed in a way that makes it easy to be used for teaching several academic and scientific topics (Short,

2012). Several studies found that MC is helpful for players in the general population, and has improved their social skills, such as sharing, collaboration, communication, engagement, and leadership skills (Al-Washmi et al., 2014; Bebbington & Vellino, 2015; Callaghan, 2016; Choo, Karamnejad & May, 2013; Cilauro, 2015; Davis, Boss, & Meas, 2018; Dezuanni, O'Mara & Beavis 2015; Elliott, 2014; Gauquier & Schneider, 2013; Hollett & Ehret, 2015; Hong-An, 2016; Nebel, Schneider & Rey, 2016; Niemeyer & Gerber, 2015; Overby & Jones, 2015; Quiring, 2015; Rexhepi, Filiposka & Trajkovik, 2018; Sáez-López, Miller, Vázquez-Cano, & Domínguez-Garrido, 2015; Schuster et al., 2015; Smolčec & Smolčec, 2014; Voiskounsky et al., 2017; Wendel et al., 2013; Wernholm & Vigmo, 2015; Willett, 2018). However, there is still a limitation about the relationship between the use of MC and teaching or learning (Hanghoj et al., 2014), especially for children with ASD and HL, whom are included in this research.

For this investigation, a systematic review of all published research into the use of MC for educational purposes was conducted (see Chapter 4), to summarise and synthesise the current findings of the value of MC in educational settings for all children. It included all first-hand-data peer-reviewed papers in educational, sociological and psychological research written in English from since the time of the game's launch in 2010 till April 2018. Thirty-six papers were identified, but none of these articles included children with ASD or HL in their sample, except some papers that were excluded (discussed in § 0), and none of the included articles investigated the associations of MC with mental health or relationship skills. Thus, this investigation seeks to contribute to current knowledge of the association between MC and relationship skills, and in understanding the benefits of MC for children with ASD and/or HL, as no research has yet attempted to understand the impact of MC on children's relationship skills and mental health status.

1.3 Original Contribution to the Research

Children with special needs might be able to overcome some of these needs through online interaction. Children can navigate the space in an online world that is similar to reality using just small movements. Small sensory movements might generate

substantial advantages in the whole body, which can support the development of a skill, such as by engaging in an efficient learning or movement in a different world (Bosco et al., 2019; Delafield-Butt & Gangopadhyay, 2013); thus, MC might help children with ASD or HL to develop their social and relationship skills. Also, people without disabilities will have a better understanding of ASD and HL if they interact with players with these conditions online and will be able to overcome their stereotyping issue and develop a beneficial relationship. Furthermore, although MC is one of the most famous games worldwide, the impact of the game on students with social difficulties has not been thoroughly investigated. This, the primary purpose of this research is to study the role of MC on the social and psychological outcomes of children with ASD, HL and with no disabilities for comparison. This would provide a better understanding of the impact of similar OCG on the relationship skills and mental health problems of children with these conditions. By exploring the usage of OCG, and specifically MC, parents, teachers, and policymakers will be informed as to whether this game could help to develop children's relationship skills and peer acceptance. This game might also be used as a supportive activity that could contribute to better mental health.

Thus, for this particular research, I hypothesised that MC is a useful tool for developing children's relationship skills and improving their mental health status. It might be an arena that gathers people from different abilities to share playing and learning or developing a healthy relationship, where they share similar interests. This assumption is constructed based on several studies, as mentioned above, that found that MC was helpful in improving players' social skills, in general, such as sharing and collaboration skills as well as communication, engagement, and leadership skills. However, as I have stated, there is no identifiable study about how MC might have an impact on developing relationship skills and mental health problems for children with ASD or HL, which is the gap that this study is trying to fill.

1.4 Thesis Structure

Each chapter of this thesis commences with an introduction that informs readers of what the researcher expects to achieve in that chapter. This approach assists the reader in focusing on what the research is about and how it is relevant to the content of the topic. Regarding the end of each chapter, there is an overall summary of what has been achieved. The structure of the thesis as follows:

Chapter 2 consists of a review of the mental health and development of social relations, as well as the importance of relationships with others for better well-being. It describes how humans, as social creatures have the desire and the need to engage with others and have a shared understanding with others (intersubjectivity). A summary of the development of intersubjectivity and its differences with the theory of mind is then presented and followed by its state of development for children with special needs. After that, there is a presentation of the development of relationship skills for children with ASD or HL, with this section then concluding with a summary of some factors that may affect children's relationship skills besides mental health states. All these areas of discussion are important to this thesis, as the focus is on the development of relationship skills, which rely on engaging with others.

Chapter 3 presents a review of the use of OCG in learning and its philosophical and psychological ground. It also presents an overview of the possible advantages and disadvantages of OCG and its cultural context. This chapter contributes to this thesis by providing a better understanding of OCG roles in learning and mental health.

Chapter 4 consists of a systematic review of the use of MC. This review examines all available research on MC used as a method of teaching or developing students' skills, and its benefits or drawbacks. It examines all available peer-reviewed published research up until April 2018. The purpose of this chapter is to provide a strong background of MC and identify the gap that this study is trying to fill.

Chapter 5 concentrates on the research methodology, philosophy, paradigm, design, data collection, and ethical consideration. It discusses the rationale and

methodological detail for this study. The purpose of this methodology chapter is to provide information about the research procedures so the study can be replicated.

Chapter 6 presents the findings of the collected quantitative data and analysis of the obtained results from online questionnaires. This chapter, at the outset, provides demographic details of respondents. Tables and diagrams of a descriptive summary of the data have been used to afford simplistic writing. It has been placed in its own chapter as it is substantial as the whole result chapters.

Chapter 7 presents the data analysis for the first research question: do children with ASD play OCG, specifically MC, more than TD children? It was an essential question which was used to establish the extent to which participants play MC more often. The results are utilized to explain subsequent groups in their use of MC as an OCG. Discussion related to this specific question is included.

Chapter 8 offers the data analysis and discussion regarding the second research question: whether there is an association between playing MC and children's social-emotional and behavioural outcomes. The outcomes of this chapter are significant as they can inform parents, teachers and healthcare professionals as to whether MC is a safe tool to be used for social interventions.

Chapter 9 presents the data analysis regarding the third research question: whether there is an association between the playing of MC with others and players' peer relationship problems score. Discussion related to this specific question is included. This chapter went from children's general social-emotional and behavioural outcomes to peer relationships specifically, and from playing MC to the score of playing MC with others to provide a tight examination of MC's impact.

Chapter 10 offers a discussion of the qualitative findings, seeking to understand the phenomena of playing MC from the perspective of parents and children's observations and interviews. The results of this chapter are used to discuss some of the results of the previous chapters using the convergent mixed methods design.

Chapter 11 summarises and discusses an overview of the thesis, followed by a recommendation for future implementation and for future research. The chapter

presents an evaluation of this project and its limitation. Overall, this thesis has the potential to advance the understanding of the role of OCG, and MC in particular, in social-emotional and behavioural outcomes for children, especially with ASD or HL.

CHAPTER 2: MENTAL HEALTH AND DEVELOPMENT OF SOCIAL RELATIONS

2.1 Introduction

This chapter provides background to the difficulties that children with ASD or HL experience in respect to relationship skills. It reviews the mental health and development of social relations including intersubjectivity. In this research, the term "relationship skills" is used to define any relationship, for example with parents, siblings, teachers, peers and friends, which is considered to be suitable for the children's age in this investigation; thus, sexual and romantic relationships are not included in this term for this research.

First, learning, education and the educational community need to be defined. Educationalists have different views on the purposes of education. According to John Dewey (2004, p.83, *original in 1960*), "Education is reconstruction or reorganisation of experience which adds to the meaning of experience and which increases the ability to direct the course of subsequent experiences". He also stated:

> Education, in its broadest sense, is the means of this social continuity of life. Every one of the constituent elements of a social group […] is born immature, helpless, without language, beliefs, ideas, or social standards. Each individual, each unit who is the carrier of the life-experience of his group, in time passes away. Yet the life of the group goes on. […] [People must] be initiated into the interests, purposes, information, skill, and practices of the mature members: otherwise, the group will cease its characteristic life. (Dewey, 2004, pp.2-3)

John Dewey, the father of today's Pragmatism, believed that school should highlight practical and experimental learning through social experience and hands-on problem-solving interdisciplinary, as learning should help learners to adapt to their environment and avoid repeating mistakes (Hickman, Neubert & Reich, 2009; Ormerod, 2006). The "implication is that learning is a process of experiential growth" (Hlebowitsh, 2006, p.74). Pragmatism, according to Ormerod (2006) believes that

truths are what work at a particular time in that context and that knowledge is imperfect. New facts should be adjusted for existing knowledge and theories are developed to simplify and support practice. Experience is a core of learning because it can determine the value of theories and that any action is an experiment that can be evaluated based on its outcomes. Finally, individuals have a different psychological nature of meaning and meaning is personal because people have different ideas, beliefs and decisions (Ormerod, 2006). Thus, the role of education for pragmatists is to be practical and part of life (for more information about pragmatism refer to § 5.2).

In the next section, the development of social relations is presented, as it is an important element of the mental health state for all children, and it is key in all educational environments. Similarly to what has been stated previously, social relations can be developed well through social experience and hands-on problem-solving, where children learn to socialize through daily social interaction experiment that is evaluated based on its outcomes.

2.2 Mental Health

Mental health is the state of a person's welfare and well-being psychologically. This term is very generic and cannot be studied as a whole; thus, in this research, I focus on the Strength and Difficulties Questionnaire (SDQ), which can demonstrate social-emotional and behavioural outcomes (the SDQ is presented in §5.3.3.1).

Before the SDQ was selected, multiple instruments were considered (some of them have been reviewed by Korkeila, 2000), but not used for multiple reasons. The first reason was that those instruments did not fully meet the scope of this thesis, such as the Interpersonal Relations Questionnaire (IRQ). The IRQ consists of 117 statements which aim to evaluate the personal, social and formal relations of learners aged 12 to 15 years old on the basis of 12 components of adjustment (i.e., Self-confidence; Self-esteem; Self-control; Nervousness; Health; Family influences; Personal freedom; Sociability in general, with the opposite sex, with the same sex; Moral sense and Formal relations) (Joubert, 1981). Another candidate instrument that can be helpful in the relationship part of this thesis is the Social Support Questionnaire, the short

version (SSQ6); however, it was not suitable because it required the participant to list the people they know and can count on for support (Sarason, Sarason, Shearin & Pierce, 1987). Another considered instrument was the Adult Sibling Relationship Questionnaire (ASRQ) (Stocker, Lanthier & Furman, 1997); but it was not used because it is limited to sibling relationship and may not be suitable for peer relationship. Furthermore, the Interpersonal Competence in Peer Relationship (ICPR) aims to assess five dimensions of competence: initiating relationships, self-disclosure, asserting displeasure with others' actions, providing emotional support, and managing interpersonal conflicts (Buhrmester, Furman & Wittenberg, 1988); however, it was not used in this study because, while it is suitable for adults, it has not been validated for children, which are the scope of this study.

The second reason is the length of the instruments, similar to the IRQ, which include 117 statements whereas the SDQ consists of only 25 items, which is important for increasing completion of participation. The Social Health Questionnaire (SHQ) is another example of nominated instruments, which consists of 76 items derived from multiple mental health recovery measures; however, it was not used because of its large number of items (Carlson et al., 2011). The ASRQ also was not used for the same reason, as it consists of 81 items, which may be considered a high in comparison to the SDQ.

The third reason is that some of the considered instruments were not available in Arabic or have not been validated in Arabic and, therefore, may not be fully suitable to be used in KSA. An example of this is the IRQ, which was standardised for White learners in Grades 7 to 9 and not available in Arabic. The SHQ and ICPR also have not been translated to Arabic nor used with Arab participants. Furthermore, the Friendship Questionnaire (FQ) aims to uncover how adults of normal intelligence report on the style of their friendship where “A high score on the FQ is achieved by the respondent reporting that they enjoy close, empathic, supportive, caring friendships that are important to them; that they like and are interested in people; and that they enjoy interacting with others for its own sake” (Baron-Cohen & Wheelwright, 2003, p.510); however, it was not used because it has not been

translated to Arabic nor validated with Arab participants. Another considered instrument is the social communication questionnaire (SCQ) (Rutter, Bailey & Lord, 2003); however, this was not used because it has not been translated or validated in Arabic at the time when this thesis was being designed (it has been validated recently and published by Aldosari et al., 2019). Therefore, in consideration of the above, the SDQ was selected for its advantages (presented in §5.3.3.1).

As introduced in §1.2, many studies have noted that children with ASD and HL have greater mental health problems, such as emotional difficulties due to the impact of the disability (e.g., Brown & Cornes, 2015; Hindley, 2005; Ghaziuddin, 2005). In this section, common mental health problems among these populations are discussed.

Simonoff et al. (2008) examined the association of psychiatric disorders that may contribute to ASD and found that one-third of children have three or more disorders besides ASD. According to Simonoff et al. (2008), "The most common disorders were social anxiety disorder (29.2%) [Reported by Lader (2015) at 3.75% with the TD population], ADHD (28.1%), and oppositional defiant disorder (28.1%). Other disorders occurring in ≥10% of children with an ASD were generalised anxiety disorder (13.4%), panic disorder (10.1%) and enuresis (11%)" (p.926). Anxiety is very common where 46.8% of children with ASD show levels of anxiety compared to 15.3% of the TD children (Syriopoulou-Delli et al., 2018), especially during the transition period from primary to secondary schools (Hannah, 2008; Hannah & Topping, 2012), Which is recognised as a fundamental phase for children's social-emotional and academic learning (Hannah, Gorton, & Jindal-Snape, 2010; Jindal-Snape & Hannah, 2014).

Anxiety disorders are one of the mental health issues that are very common among children with ASD and can lead to depression and suicide or negatively impact self-esteem if not treated (Hedges et al., 2018). White et al. (2009) reviewed 40 papers about anxiety and ASD and found that anxiety statistics range between 11% and 84%. Simonoff et al. (2008) reported that the prevalence of any anxiety or phobic disorders among people with ASD is 41.9%, which is very high compared to the general population, reported in a 12-month European study at 1.7% (Lader, 2015). There is significant variability in anxiety disorders' prevalence across studies of children with

ASD; in fact, some people with ASD fail to report symptoms due to communicative deficits. Anxiety disorders also impact the socialisation skills of children with ASD, reducing social interaction with friends and peers (Bellini, 2004). Also, the prevalence of emotional disorder in children with ASD was reported as 44.4% (Simonoff et al., 2008), and 51% of parents of children with ASD thought that their children had shown emotional problems compared to 4% of parents of children without ASD (Green et al., 2005), highlighting the impact of ASD on children's mental health.

People with ASD often have other forms of mental health difficulties, such as hyperactivity/inattention. According to Simonoff et al. (2008), 28.2% of people with ASD have attention-deficit/hyperactivity disorder. Forty-two percent of parents of children with ASD thought that their children had a form of hyperactivity compared to 3% of parents of children without ASD (Green et al., 2005), impacting children's ability to socialise and communicate with others. In addition, 71% of parents of children with ASD thought that their children had behavioural problems compared to 6% of parents of children without ASD (Green et al., 2005).

Children with HL also often have mental health issues. Students who wear hearing aids tend to have negative self-esteem due to the negative attitudes of others (Polat, 2003), although this might be a result of social and communication difficulties (Luckner & Movahedazarhouligh, 2019). A study by Brown and Cornes (2015) investigated the mental health problems of 89 deaf or hard-of-hearing adolescents and found that students with HL have more mental health problems than hearing peers; the prevalence of mental health issues among deaf students was 39%. The significant predictor of mental health was the type of communication at home; students who used spoken English at home had fewer mental health problems than those who used sign language. Also, Theunissen et al. (2011) investigated the prevalence of depression among students with HL and found that people with HL showed significantly more symptoms of depression than hearing peers, and students with HL who attend special schools or use sign language only may feel more isolated. The chosen communication mode should allow deaf students to express themselves (Polat, 2003). The earlier the HL occurs; the less poor psychosocial adjustment would

result. Deaf-born children showed fewer behaviour and personality problems compared with children who lost their hearing later. This might be because they are able to speak, but not to listen or because they have heard voices and are not able to adapt to their current position (Polat, 2003).

Although most of the children with HL are as intelligent as their hearing peers (Maller & Braden, 2011), children with HL have more social and emotional problems compared to their hearing peers (e.g., Antia & Kreimeyer, 2015; Batten, Oakes, & Alexander, 2014; Punch & Hyde, 2011; Rieffe, 2011). Moreover, Wiefferink et al. (2012) reported that children with HL are less socially competent and have significantly more problems with emotion regulation and peer relationships than their hearing peers at the same age. Brown and Cornes (2015), concomitantly, reported that individuals with HL have high percentages of internalising problems, such as anxiety or depression, and externalising problems, such as aggression. All these internalising and externalising problems will definitely have an impact on their social-emotional development and how children with HL behave and learn in schools (Szymanski et al., 2013). Therefore, parents, educators, administrators, interpreters, and all the society parties need to work collectively to prevent these social-emotional and behavioural problems and to ensure that children with HL are feeling safe and welcomed as well as integrated with the hearing people.

Children with comorbidity of ASD and HL also have some mental health issues that prevent them from socialising. Peterson et al. (2016) investigated the theory of mind and social skills of 5–13 year olds, divided into four groups: ASD (n=76), severe or profound HL where no one signs in their family (n=54), severe or profound HL who were born into a signing family (n=12), and TD children (n=53). The results of the theory of mind understanding show that deaf participants who signed later scored significantly lower than TD children, but similar to children with ASD. Late-signing deaf children and children with ASD were delayed considerably in understanding the theory of mind, but children with ASD have less adequate social skills and language ability. Although this study has an unbalanced sample, the results support the correlation between theory of mind understanding and social skills performance. In

consequence, promoting mental health and children's ability to understand others is important.

In summary, there is an observable disruption in the development of the mental health of children with ASD or HL. Presented mental health issues may contribute to deficits in the social-emotional and behavioural development of these children. In the following section, the development of social relations and intersubjectivity as well as how relationships are formed will be discussed with the emphasis on the target groups: children with ASD and HL.

2.3 Development of Social Relations

Humans are social creatures with an innate desire to engage with others (Hyslop, 2005; Trevarthen, 2009; Trevarthen & Delafield-Butt, 2014). Social interactions play an important role in social and associated skills (Delafield-Butt, 2018). An individual's identity within interactions is different from one situation to another, and these interactions form the individual's behaviour (McGann, 2014). Importantly, social and cultural interactions are integrated, so every social interaction is desired through some degree of cultural belonging (Hilgers, 2009; Gratier & Trevarthen, 2008). Emphasis on social contact in learning requires an enjoyable and fun method for improving social and cognitive developments that provides an emotional and embodied basis to learned facts, as they are lived and shared (Delafield-Butt, 2018).

Social and psychological theories provide a better understanding of the relation between structure and subject or between individual and society. Development of psychological theories depends on several perspectives. For example, in psychoanalytic theories, development is the impact of early childhood events on the personality profiles, and competence development is impacted by the earlier stages in cognitive developmental psychology (Frönes, 2007). These theories can explain how our culture and society are formulated, how interacting with individuals and subject is manifested, and how interaction is made between the innate capacities and environment, socialisation constitutes, and individuals (Frönes, 2007). Educational theory, by itself, cannot be useful in understanding learning without considering the

sociological, psychological and clinical positions of learning. For example, Trevarthen (2009) demonstrated that educational theory misrepresents collaborative learning and its impact on children's health. According to Gee (2013), collaboration tends to be labelled as cheating in the traditional curriculum, while it is the goal of most digital games in learning, as collaboration is compulsory for all social skills. For John Dewey (Dewey, 2004, p.5), what is meant to be a single individual in a society is that

> Individuals do not even compose a social group because they all work for a common end. The parts of a machine work with a maximum of cooperativeness for a common result, but they do not form a community. If, however, they were all cognizant of the common end and all interested in it so that they regulated their specific activity in view of it, then they would form a community. But this would involve communication. Each would have to know what the other was about and would have to have some way of keeping the other informed as to his own purpose and progress. Consensus demands communication.

Dewey indicated that a person's life is through a group even if that individual is a separate part. He argues that education is a preparation for a better life and is a continuous and commutative process. Dewey further highlights that every individual should work toward common goals for society.

Educationalists, sociologists and psychologists recognise the importance of social identity; an identity that is influenced and formed by being an individual and belonging socially (Frönes, 2007). Social lives are filled with moods, feelings and attitudes that include acting, perceiving, engagement, relation and connection status, negotiation, and socio-cultural norms, and are influenced by social and agent cognitions (Di Paolo & De Jaegher, 2015). According to Frönes (2007), "psychological theories invite an understanding consistent with sociology's idea of primary socialization: The child's point of departure is not social; the little animal is being forced into the social world in the first years of life" (Frönes, 2007, pp.206-207). This may be overlooked at schools, as schools exercise symbolic violence against the school community where, for example, teachers do not have freedom to make changes in education as it is due to the social inequality (Hollingworth, Mansaray,

Allen & Rose, 2011); thus, children are not taught an objective culture, but the dominant culture. According the policy context in Scotland, The early year's framework, children have the rights to services that aim to reduce potential inequalities, such as on disability or social background, emphasising the role of all society members in providing high quality and decentralised universal services that meet children's social-emotional and academic needs (Jindal-Snape & Hannah, 2013). However, some schools fail to recognise and address students' additional needs. As a result, establishing digital social capital can be very helpful for people with a disability (Davis & Boellstorff, 2016). Hence, this study tries to understand these additional needs through the online environment, where OCG may create a social environment for participants to interact with whomever they like and as they wish, and not be forced to follow a concept or an ideology for social interaction.

Intersubjectivity seems to be substantial due to the separation between psychology and sociology (Gillespie & Cornish, 2010); hence, reviewing intersubjectivity will fill the gap between these two fields, which is important for studying the phenomenon of OCG among children with special needs, and is necessary for understanding the educational system, as it is based on psychology and sociology elements. Intersubjectivity is helpful in understanding to what extent children with special needs comprehend the meaning of interaction with others (presented in the next section), such as their parents, teachers and peers. Understanding others is a key to developing healthy relationships with others, to improving children's mental health.

Before the intersubjectivity is introduced, it is essential to distinguish between attachment and having a relationship. 'Attachment' is a general emotional and psychical process, which can include being attached to objects, events and people, whereas 'relationship' is a term usually used to describe a two-way connection. According to Baron-Cohen and Bolton (1993), many infants with ASD may appear to be emotionally attached to their parents, but this is not always the case; thus, in the early stages of ASD, it was defined as the failure to develop typical attachment behaviours (Rutgers et al., 2004). In the upcoming sections, intersubjectivity will be discussed, as it is a critical element in developing relationships with others.

2.4 Introduction to Intersubjectivity

Intersubjectivity is defined as a group of "relations, meanings, structures, practices, experiences, or phenomena evident in human life that cannot be reduced to or comprehended entirely in terms of either subjectivity (concerning psychological states of individual actors) or objectivity (concerning brute empirical facts about the objective world)" (Zurn, 2008, para 1). Trevarthen and Aitken (2001, p.4) defined it as the "awareness specifically receptive to subjective states of other persons". Moreover, Trevarthen and Delafield-Butt (2017) defined intersubjectivity as having shared understanding that recognises meaning as socially mediated based on one's position (experience and biases); it also means that we share understanding with others, but this understanding is not identically defined. For example, from the intersubjectivity perspective, "the understanding of myself as a subject is based on the recognition of the other as a subject"; thus, understanding intersubjectivity "developed through the processes of socialization" (Frönes, 2007, p.215).

Intersubjectivity is also defined as "the explanation of how an individual can know the other, not merely as an object, but as a co-experiencing subjectivity" (Adams, 2011, p.3). Thus, it can be thought of as co-subjectivity, as each person experiences the subjectivity of others to some degree. But, the "experience itself is accessible only to the unique consciousness of the person having it. That person can talk to others about it, but the actual experience remains subjective and private" (p.3). Simply, intersubjectivity is the shared meaning between two subjects: the more the meaning is shared, the more the two subjects can understand and sympathise with each other. The more we sympathise with each other, the closer to each other we would be; thus, intersubjectivity is a core for developing relationships with others.

Humans are social creatures who want to engage with others' knowledge and habitus, as recognised through infants' reactions to the playful attention of companions (Trevarthen & Delafield-Butt, 2014). Engagement through playing and sharing experiences by using communication gestures and facial expressions indicates that all humans are born with social-bond, developing a social and cultural common sense (Delafield-Butt & Trevarthen, 2017; Trevarthen & Delafield-Butt,

2013a, 2017). Sharing and understanding one's own and others' emotions is essential to the development of the brain and consciousness and can be translated into engagements between adults and infants or between acquaintances and peers (Bràten & Trevarthen, 2007; Gratier & Trevarthen, 2008). These studies show that children are capable of sharing and developing social relationships through playing, sharing and engaging with each other. Frönes (2007, p.215) states:

> The image of the other develops through socialization, from the simple subject who is one like myself but still another, to the other as beings like me but at the same time different, and even a mystery, the known unknown…The more we know about others, the further, deeper, and more different the other becomes, while at the same time becoming closer.

Understanding minds is very complex; but it is a fundamental aspect of human brains and a significant action for humans (Dant, 2014; Trevarthen, 2009). Intersubjectivity is key to social relationships as people cannot have a relationship with each other if they cannot understand each other (Gillespie & Cornish, 2010). Moreover, the intersubjectivity ideology claims that each individual has unique principles or assumptions that unintentionally shape that person's experience (Trop, 1995), but experience cannot be separated from embodied social experiences, so it cannot be an entirely solitary experience (Applebaum, 2012). These experiences might be the example of sharing meaning with others, although others may experience the experience from a different angle due to how the two subjects empathise with the events. For instance, people often communicate in general terms and do not include precise details, which has a tendency to be assumed by audiences (Gillespie & Cornish, 2010). In fact, the more we have intersubjectivity, the more we can assume, understand and get these specific details. Another example of intersubjectivity is when an adult has a conversation with a child. The adult might unintentionally simplify their language. This change in language is intended to share the meaning of the thought or idea with the child. Thus, people with average abilities practise intersubjectivity in their daily communication without being aware of it.

Understanding one's own and others' minds have been debated among different philosophers and psychologists. Hyslop (2005) stated the concerns about trying to understand others' minds: "how our beliefs about mental states other than our own might be justified…[and] how is it possible for us to form a concept of mental states other than our own" (para. 4). Hyslop was also concerned that it is not possible to have full access to our own mind rather than accessing others' minds. However, intersubjectivity does not entirely mean an understanding of another mind; it means sharing understanding regarding an object or thought. Awareness of ourselves can be a result of the recognition of others, so the sense of others is a previous step to knowing ourselves. Hyslop claims: "we depend on others not merely for our existence, but for our very sense of ourselves, and our awareness of others is claimed to be at the heart of our awareness of ourselves" (2005, para. 54).

Moving from subjectivity to objectivity is difficult unless through intersubjectivity, which includes awareness of others. Others are different from "me", but they share conscious subjectivity. I cannot understand my subjectivity unless I understand others. Some scholars argue that understanding others is impossible because each one is a private unit (Hyslop, 2005); however, intersubjectivity means the relationship between people that is different from their subjectivity and objectivity. It is based on people's shared understanding rather than a subject's understanding. Knowledgeable subjectivity can only realise itself through the context of a relationship with others and its openness to the world and to others, which is also through communication, interaction and harmony between subjects.

Overall, children have two ways of learning: subjective, through the senses, and intersubjective, through interaction. Although there is a doubt about attentional engagement for children with ASD, "it may just be that their engagement takes less visible forms or that it occurs under certain conditions" (Reddy, 2008, p.118). This is a sense of engagement that has been stated as an essential element of social and mental life. Thus, these forms of engagement need to be studied.

2.4.1 The Development of Intersubjectivity

Children's direct engagement with others develops their understanding of themselves and others; thus, psychologists and researchers need to see why and how infants engage with others in order to understand how they develop their consciousness of other people's minds (Delafield-Butt & Trevarthen, 2017; Gopnik & Seiver, 2009; Gratier & Trevarthen, 2008; Reddy, 2008). Human social life depends on sharing and communication through generations (Trevarthen & Delafield-Butt, 2013a). Researchers have observed that infants engage with others at a very early stage of development (Trevarthen & Delafield-Butt, 2017).

Very young infants are able to interact and socialise with other infants even without the presence of adults (Trevarthen & Delafield-Butt, 2013a). Moreover, children are very skilled in sharing pleasures with people who work with them (Trevarthen & Delafield-Butt, 2013a). Babies are very interested in people who speak to them, and they respond by developing a positive personal relationship that is critical to their mental health improvement, and interpersonal dialogic, verbal and nonverbal, which are fundamental in promoting understanding of social and cultural values (Trevarthen & Delafield-Butt, 2013a). However, the question that has not been answered is whether children with ASD develop these skills in their infancy. All previously mentioned skills that children form in the early stage of infancy are imperative to create shared meaning and intersubjectivity between people, thus promoting social interaction and social relationships.

Infants' ability to operate these skills will advance through three levels of intersubjectivity. Infants are born with an ability to communicate with others; they can imitate adults' facial gestures just 45 minutes after birth (Bràten & Trevarthen, 2007), which seems to be the beginning of intersubjectivity. Infants start to engage and pay attention to others and the world from three months old through participation in activities and imitation of others (Trevarthen, 2009). Children are capable of imitating successes, avoiding mistakes and understanding their limitations by recognising the relationship between personal goals, actions and outcomes (Gopnik & Seiver, 2009). Importantly, imitation is an essential key to learning

according to Albert Bandura's Social Learning Theory, where the emphasis is on learning through social observations and imitation (Ormrod, 2011). As can be seen, the focus is on social interaction, and imitation develops in the very early stages of life for TD children, which indicates how social life is essential.

Gopnik and Seiver (2009) also discussed the stages of how children develop their understanding of others. Children are able to understand perception and attention that is shared by others at approximately one year old as well as the pattern of their action and others' action, which helps them to distinguish between people and things. By eighteen months, children show understanding of love and emotions. Children understand the relationship between emotions and action between two and six years of age. Children also learn the relationship between our beliefs and the environment or the world at around five years old. By five years, children may start to develop their self-control as well as executive control, which mean the ability to control their own feeling, thoughts and actions. At six or seven years, children start to make inferences about others and understanding that people have different personalities (Gopnik & Seiver, 2009). Moreover, Bràten and Trevarthen (2007) demonstrated that children between three and six years old start to manifest the ability to understand others' thoughts and emotions, which is known as the theory of mind. Therefore, scholars think that children start to develop and understand a sense of others' thoughts and personality from around the age of six.

According to Bràten and Trevarthen (2007), three main levels of intersubjectivity are presented: *Primary intersubjectivity*, dialogical interactions between an adult and an infant that leads to specific emotions; *Secondary intersubjectivity*, in which a child acknowledges others by sharing interests and labelling people or objects; and *Tertiary intersubjective*, where a child is able to understand narrative dialogues and shows an understanding of others' minds and emotions. Children at this level are capable of understanding the theory of mind and understanding jokes. Children cannot develop the secondary and tertiary levels if their primary social-self has not been developed (Adams, 2011). This matrix distinguishes the layers of intersubjectivity in normal life. Importantly, the more children understand others'

minds, the better social skills they perform. In short, children's brains can develop accurate conclusions about another person's characteristics with little details (Gopnik & Seiver, 2009). These engagements between infants show that children are ready for communicating, which is critical for interaction.

2.4.2 Intersubjectivity and Theory of Mind

There seems to be a gap in the literature concerning the relationship between theory of mind and intersubjectivity. According to Premack and Woodruff (1978), the theory of mind refers to the knowledge of mental health states of a person and others. On the other hand, intersubjectivity is a primary element for developing the theory of mind. According to Dant (2014), intersubjectivity is a phenomenological approach, which means that an individual has to engage with others' lives in order to be able to understand and explore another person's mind. It follows "a philosophical method of reflection, introspection, and thought to explore what must be the case for consciousness to be possible" (p.46).

Dant (2014) stated that there are five steps to describe becoming aware of others' minds: being aware of others' internal and external engagement; understanding sensory experience through an imagination of apperception; sharing emotions and feeling or empathy; recognising a sensation when someone looks at someone else or the feeling of being looked at without being able to respond; and interpreting the meaning of language and gestures. Thus, in order for individuals to establish intersubjectivity, they need to experience others' minds because the more a person knows another person, the easier it is to establish shared meaning. Most individuals with ASD cannot easily understand the habits of people without ASD or how they think and act, and vice versa; thus, understanding others is an essential aspect of shared meaning. However, it is supposed that people cannot fully understand others unless they share a social and personal identity, which seems to be impossible. To summarize, it is possible to say that understanding the theory of mind requires a solid development of intersubjectivity.

2.4.3 Children with Special Needs and Intersubjectivity

Children with ASD, in particular, have difficulties with mentalization, which is the ability to understand the mental state of others and the theory of mind. Furthermore, individuals with ASD may find it hard to comprehend fiction because they are unaware of others' thoughts (Baron-Cohen & Bolton, 1993). Children with ASD usually have an impact on their primary or secondary intersubjectivity, and it seems that the lack of having the intersubjective meaning of interaction is due to the lack of understanding others or the development of intentionality (Delafield-Butt & Trevarthen, 2017). Hypothetically, if "others" (people without ASD) were objects, then individuals with ASD could understand them and easily interact with them; however, since "others" are single subjects, children with ASD may not be able to understand them because "others" have subjective identities. People do things or interact differently based on various situations and positions. As a result, children with ASD supposedly can easily understand OCG because games are objects that have roles, which can be understood.

In order to have stable and meaningful relationships with each other, people need to be able to read and understand others' thoughts and feelings. Children with ASD have difficulties in taking others' thoughts into account, so their actions may be confusing to others (Baron-Cohen & Bolton, 1993). Also, the more we understand others, the more we empathise with them (Gillespie & Cornish, 2010). Children with ASD tend to lack empathy, perhaps due to their lack of understanding of others and their difficulties in mirror neuron (Gillespie & Cornish, 2010), which is responsible for affecting a person's observation of an action performed by another. Humans share their environment; therefore, they participate in each other's perception, and the more people become close to each other, the more embodied intersubjectivity can be seen as they share empathy. Sharing empathy is an essential aspect of intersubjectivity because it is based on understanding others as other subjects. It seems that the difficulty that children with ASD have with intersubjectivity is due to the way they learn: they usually learn better through experience; hence they cannot fully understand others because it is hard to experience others as oneself. Thus, the

ability of children with ASD or HL to understand others might be disrupted due to differences in social identity.

Children with HL may not be able to develop the ability to understand others due to the shortcut in their symbolic function disruption which is caused by the shortage in developing language (Damen, Janssen, Ruijssenaars & Schuengel, 2015; Gastão Saliés & Starosky, 2008), although this delay can be developed through meaningful forms of social interaction over time. The ability to understand other's minds and behaviour is an issue for children with sensory problems due to the lack of auditory interaction, which may result in being unable to develop intersubjectivity fully; this will result in another lack of developing complex interpersonal communication (Damen et al., 2015). Being unable to connect and engage with others communicatively causes a deficiency in the development of subjectivity and/or intersubjectivity (Gastão Saliés & Starosky, 2008). Therefore, children with HL may develop intersubjectivity later than TD children, similar to children with ASD.

In summary, in order to develop intersubjectivity, people have to realise that others are a single subject and have subjective identities as well as understanding personal and social identity. Social relationships stand on having intersubjectivity, which can be formed through sharing meaning. It is transmitted between societies through simulations and then influences society's thoughts, affections, cultures and general knowledge. This knowledge consists of shared psychological, emotional, social and cultural experiments, and involves shared feelings, aspirations, inferences and beliefs. People cannot understand others without interacting with them. All people need friends and to have solidarity, coexistence and engagement with "others". This is necessary to create an emotional relationship that is based on harmony and understanding without bias and introversion.

2.5 Developing Relationship Skills for Children with ASD

Apart from having difficulties in reading and interpreting others' thoughts and feelings, children with ASD have difficulties in communication (Baron-Cohen & Bolton, 1993; Chilvers, 2007). Language and communication are keys to social

interactions and developing relationships with others (Bagwell, 2004; Hay, Caplan & Nash, 2009). These difficulties may exist in different levels and intensities, as some children may not develop any practical speech, or have speech problems such as echolalia (i.e., repeating another person's spoken words). They may include preverbal communication, such as pointing to an object, or non-verbal communication, such as using gestures (Baron-Cohen & Bolton, 1993). These difficulties may be associated with other social problems, such as abnormality in facial expressions or failing to make eye contact, thereby making communication harder. Educators aim to reduce the impact of communication difficulties on the social and learning lives of children with ASD, such as by using sign language (Baron-Cohen & Bolton, 1993). These social communication problems may increase social challenges, such as not being able to defend their rights, passing an interview, and expressing their needs. Therefore, although children with ASD may have some communication difficulties that under-develop robust progress of intersubjectivity and intentionality, they have to develop different types of relationships, with parents, siblings and peers.

2.5.1 Relationships with Parents

Parents' relationships with children influence how children develop their social skills, through parental behaviours and cognitions experiences as well as the warmth and control experiences (Grimes, Klein & Putallaz, 2004). In the early history of ASD, some theories suggested that autism might be caused by a weak relationship between children and their parents; however, this is no longer accepted. Parents of toddlers with ASD report feeling rejected or blaming themselves for doing something wrong with their child (Chilvers, 2007). Rutgers et al. (2004) conducted a meta-analytic review of 16 studies to find whether children with ASD can create a secure attachment with their parents compared with children without ASD. Most of the studies showed evidence for attachment behaviours in children with ASD, but that the attachment is significantly less secure than for other children. Children with ASD looked at their parents less and maintained interaction less compared to the control group. Researchers stated that: "parents of children with the autistic disorder are less able to establish a secure attachment relationship with their child, because of the

severity of the impairment in the reciprocal social interaction of their child" (p.1131). Children with lower mental development show more signs of insecure attachment. The reviewed studies were criticised in that ASD was not well defined and covered a small number of subjects. Thus, children with ASD may have a different relationship with their parents due to weak attachment, which might influence their social and emotional life and require intervention to address the attachment shortage.

In summary, it can be seen that ASD can influence the relationship between children with ASD and their parents. Indeed, it impacts parents' relationships with others, such as partners or other children. However, this is not the focus of this study, which focuses on ASD children's relationships with others, including siblings and peers, as these are the people they tend to play online.

2.5.2 Relationships with Siblings

Sibling relationships are critical for children with ASD as they may learn social behaviour rules from them. Orsmond and Seltzer (2007) reviewed relationships between siblings of individuals with ASD and the children with ASD and reports some negative aspects in respect of the siblings, such as "embarrassment, destructive behavior, social isolation, and their brother or sister's future" (p.316). However, the siblings also reported the relationship in positive terms and shared activities, such as playing together and spending time outdoors. Siblings of children with ASD in some studies reported that they have a negative role in the family and were unable to explain their sibling's disability well. The researchers concluded that: "siblings during childhood and adolescence describe positive aspects of their sibling relationship, including siblings as activity partners, greater admiration, and less competition and conflict" (Orsmond & Seltzer, 2007, p.316). Although this study reported some negative association between children with ASD and their siblings, there are also indications of positive relationships, such as sharing activities.

Buerger (2014) examined the "Siblings Helping Siblings" interventional program that was developed for siblings of children with ASD, which includes recreational activities, problem-solving lessons, coping strategies and information about ASD. The

result shows that parents' insights of sibling relationship quality improved through positive sibling interaction, especially in unstructured playtime, and there was a decrease in parental reported internalising symptoms, although target children did not show a significant change when rating their own relationship. Nevertheless, this research neglected the perspectives of children with ASD, and whether they thought this intervention helped them to improve their relationship with siblings, so we cannot be sure whether children with ASD also think that this intervention increases positive interaction; however, this thesis is seeking to discover whether playing with others, e.g., siblings, may impact children's relationship quality with each other.

White (2013) explored the relationships in families of children with ASD. Participants were siblings with and without ASD and parents from four targeted families and three focus group families as well as seven clinical professionals. The result shows that sibling relationships differ from one individual to another based on ASD traits, individuals' characteristics, and how children and families perceive and understand circumstances; however, in general, sibling relationships are not different to those between typical siblings with consideration of the complexity associated with ASD and the type or level of functioning. In addition, the qualities of siblings' interactions and involvement between children with and without ASD were fairly similar to siblings without ASD, except that some behaviour was considered as a barrier to interaction. As a result, this study shows that the siblings' relationships were almost similar regardless of having a child with ASD. However, the number of participating families was insufficient, so the result may not be generalised, and the study did not include siblings without ASD in the targeted families because all four families had a child with ASD; thus, this study cannot formulate a theory.

Overall, research demonstrated that having a child with ASD impacted the siblings' relations with this child; however, research that studied the perspectives of children with ASD toward siblings without ASD could not be identified. Thus, in this research, the focus is on whether the children with ASD improve their relationship with others, such as siblings, through OCG, and mainly MC.

2.5.3 Relationships with Peers

Peer interaction for TD children is usually influenced by many variables including the child's sex, attitudes and emotion regulation, cognitive and language, other family members, and the broader culture (Hay, Caplan & Nash, 2009). Children with ASD have difficulties in developing social relationships (Chilvers, 2007), and this might be due to one or more of the above-mentioned variables. However, for discussing this concept, there is inconsistent use of the terms 'relationships' and 'friendships' in the literature (e.g., Orsmond, Krauss & Seltzer, 2004). This might be because most research focuses on developing friendships instead of relationships. It seems that 'relationship' is a broader term and is the foundation for developing friendships.

Orsmond, Krauss and Seltzer (2004) investigated peer relationships and participation in social and entertainment activities among 235 adolescents and adults with ASD. They reported a lack of participation in social and recreational activities compared to previous research due to many individual characteristics associated with having peer relationships, such as the degree of social impairment, functional independence, higher levels of internalising behaviours, and age. Only 8.1% had at least one friend, 24.3% had peer relationships in pre-setting, and 46.4% reported having no peer relationships. Although this study showed concern about having relationships with peers among people with ASD, the research has some limitations. For example, the age range of this study is extensive (10 to 47), and extends past the adolescent period, which is what this thesis focuses on. Also, the researchers did not define what peer relationships are and how they are different from friendships.

Many identified possible reasons for children with ASD to have limitations in their peer relationships or in establishing and maintaining friendships are related to social functioning impairments (Barnhill, 2001). Children with ASD tend to prefer self-contained activities, preferring to interact with others in less emotional and more pragmatic ways due to having limitations on "their social sensitivity or awareness of the thoughts and feelings of others" (Parker, Rubin, Erath, Wojslawowicz & Buskirk, 2006, p.452). Furthermore, people with ASD may show unexpected emotions within relationships (Baron-Cohen & Bolton, 1993), which some people without ASD may

misinterpret and might result in misunderstandings or the relationship breaking down. Limited peer relationships also might be due to the child with ASD having language disruption, such as repetition and stereotypical use (Parker et al., 2006). Orsmond et al. (2004) reported that a very small number of children with ASD in their sample have a friendship relationship with peers of the same age. Thus, research indicates that children with ASD have a limitation on peer relationships and friendships due to social functioning and language disruptions.

Even though adolescents with ASD might have challenges in socialising, a study by Mazurek (2013) found that adults with ASD were attracted to screen-based technology, because it enhanced their social interactions. Most adults with ASD who participated in Mazurek's (2013) research declared that their goal of using social networking sites was to connect socially with other people, such as their friends (64.9%), whereas 22.1% responded that they used these sites for entertainment and information, and 3.9% of them used them for familial reasons. Indeed, there are many ways to encourage children with ASD to develop relationships, such as peer tutoring, school clubs, religious clubs, groups of shared interest, and online social games. The more children with ASD are supported in developing friendships, the smoother social life they will have. Developing friendships requires social knowledge, understanding social rules (Chilvers, 2007), and understanding others' thoughts and perceptions, which can be supported through online social games.

2.5.4 Importance of Friendship for Children with ASD

Friendship relationships are rarely defined precisely (Reitz et al., 2014) but, according to Berndt and McCandless (2009), there are some characteristics that make people become friends, such as sharing common interests, history, common values, and equality. Berndt and McCandless (2009, pp.63-64) stated

> Friendships are the closest of children's relationships with peers… The most basic definition of a 'friend' is someone whom a person knows and likes. Importantly, this knowledge and liking are assumed to be mutual; that is, a person does not call another person a friend unless he or she knows and likes

that person, and assumes the other person knows and likes him or her as well. But not all relationships that meet these criteria are labelled as friendships.

In other words, friendship is an advanced relationship that involves sharing a feeling toward each other. In addition, it is a commitment to a person's happiness, respecting each other's principles, and having a good influence on each other (Berndt & McCandless, 2009; Newcomb & Bagwell, 1995). Thus, friendship can be defined as a relationship between two individuals that involves advanced caring for each other and respecting each other's principles.

Some children with ASD may not understand what being a friend to someone means; some of them would define friendship as occurring with someone they have met once or twice rather than having a deep relationship (Baron-Cohen & Bolton, 1993). However, not being able to define what friendship is does not mean that the person does not want to have a friendship. In fact, there is a misconception that children with ASD do not want to have friendships with others, and they are happy being alone, which is not always true (Chilvers, 2007). Although being alone was emphasised by people with ASD, friendships were desired by individuals with ASD (Bertilsdotter-Rosqvist et al., 2015). Some children with ASD, compared to children without ASD, tend to meet their friends less often and prefer to have structured activities with their friends that have well-defined instructions and require a low level of social engagement (Chilvers, 2007).

Friendship skills are considered to be one of the main factors in social skills. People who lack friendships may experience hardships emotionally and mentally later in their life (Ferrer & Fugate, 2014). Hence, fostering friendship skills are important for people with ASD in order to fulfil their social and emotional needs. Through friendship, students develop social-emotional skills, such as communication, collaboration, negotiating different interaction circumstances and problem-solving skills (Frey et al., 2019). Children will have better views about learning and schools when they have friends there (Bagwell, Newcomb, & Bukowski, 1998). Hence, supporting children's social and friendship skills is significant, especially children with ASD or HL, so they can fulfil their social-emotional and intellectual needs.

Circle of Friends is a scheme that aims to develop social relationships and promote social inclusion of people with disabilities in mainstream settings by developing peer relationships (Goldstein, 2013). According to Goldstein (2013), there are many circles where the centre represents the individual with a disability. The second circle represents close relationships and is called the circle of intimacy. The third circle represents close relatives and friends and is called the circle of friendship. The fourth circle represents people who interact with the individual in the community, schools and other places, which is called the circle of participation. The fifth circle represents teachers, therapists and medical providers and is called the circle of exchange (Goldstein, 2013). These circles represent the importance of the relationship with a person and emphasise the circle of intimacy, which is the closest one to the individual. The Circle of Friends program can be assessed through the number of people who have been recognised and who classify themselves within the circles of friendship (Goldstein, 2013). These circles can be used to identify the relationships that an individual has and works to develop and maintain these relationships. It also can be implemented to find out how children with ASD recognise and classify their relationship with others. The more that friends and relationship circles are dispersed, the more the person is likely to be isolated.

2.6 Developing Relationships and Friendships for Children with HL

Hearing loss is mainly a disruption of communication and language, and there are many issues that are associated with having social barriers. Batten et al. (2014) reviewed 14 studies related to the social interaction between deaf children and their peers and concluded that there is a positive association between peer interaction and the deaf child's age, communication skills, and the level of inclusion, self-esteem, academic ability, and cochlear implantation that might be correlated with social interactions. These mentioned features can be used as predictors for how difficult it is to develop relationships among children with HL. However, communication is still the main barrier to developing social relationships for children with HL.

Communication is an important element of social interaction and has a very strong connection to having a limitation on peer relationships and friendships (Luckner & Movahedazarhouligh, 2019). Students with HL may not develop social and relationship skills due to the lack of interaction with hearing peers. Xie, Potměšil and Peters (2014) reviewed the interactions of children with HL in inclusive educational settings with their hearing peers and found that most of the previous research shows less communicational interaction between children with HL compared to hearing children. However, the research found that students with HL made more initiations to hearing students than hearing peers to each other, but these initiations were less successful. Ongoing interactions were more challenging for deaf than for hearing children because of vocabulary limitations. In fact, children with HL "were often rejected or ignored by their hearing peers" (Xie et al., 2014, p.431). Overall, children with HL were less successful in maintaining interaction with hearing peers due to communicational difficulties.

There is a range of mental health interventions that could be used with children with HL, but these rely on the child's communication abilities, development level and psycho-educational needs (Hindley, 2005). Wolters, Knoors, Cillessen and Verhoeven (2011) examined acceptance and popularity and its associations with communication and social behaviour with 87 deaf and 672 hearing sixth-grade students in inclusive and special classrooms. The results show that deaf students in special classes scored significantly lower on communication and being accepted or popular than deaf peers in mainstream education, and both score significantly lower than hearing peers. Deaf girls were more accepted and scored with higher prosocial skills than deaf boys in the inclusive classroom. Deaf students showed fewer prosocial skills, but higher withdrawn behaviours than hearing children. Moreover, Bobzien et al. (2013) conducted research on social communication skills using observation during cooperative play of eight pre-schoolers, four of them with HL. Participants with HL showed fewer verbal comments than their hearing peers, but more verbal turn-taking and playing turns than their hearing peers. However, children with HL used

more frequently repeated phrases such as “put it here”. Overall, these studies reported difficulties in communication skills that impacted social and friendship skills.

2.7 Other Issues Related to Developing Relationship Skills

There are many factors that may affect children’s relationship skills besides mental health states, such as educational placements, bullying and whether the children have experienced emotionally and physically violent behaviours from peers.

Firstly, there is a huge debate about whether inclusion or mainstreaming children with ASD or HL is useful in the educational system (Wauters & Knoors, 2008). People who support inclusion think that children with ASD obtain fewer opportunities to practice face to face social interaction; thus, it is essential to provide more opportunities for them to interact by integrating them with other children (Baron-Cohen & Bolton, 1993). Conversely, some scholars think that, since there is a lack of resources for children with ASD in normal classrooms which might reflect negatively on the relationship and understanding between children, it would be better to place them in specialist units (Lindsay, Proulx, Thomson & Scott, 2013). Another line of thought suggests that children with ASD can be integrated, but based on many other aspects, such as individual social abilities, the subject of the class and the availability of resources. Thus, the decision should be individual, but with the preference of providing these children with more opportunities to interact with others and the surrounding social environment because they will need to interact with others once they leave school, and the goal of the school is to prepare children for life.

Gregor and Campbell (2001) studied 49 teachers’ and 23 specialists’ attitudes on integrating children with ASD into mainstream schools in Scotland. Almost half of the specialists supported full integration, 50% of experienced teachers thought they do not have the skills to teach children with ASD. Thirty-nine percent thought that the degree of ASD and child’s personality were the most important factors, while 78% thought staff attitudes were the most important factor in the success of integration. Teachers with higher experience showed more positive attitudes toward integration. Furthermore, specialists and teachers reported many problems with integration: lack

of preparation, insecurity, problems with focus in work, ridicule or bullying, sensory overload; lack of visual cues, difficulties in communication and socialisation, large class size and less attention to individual needs; peer reactions to behaviours; anxiety; being accepted by others; and isolation. Importantly, in terms of how to help children with ASD benefit from integration, participants suggested: providing social interaction opportunities, cooperative play, learning to socialise, belonging, friendship, learning adequate behaviours from others, enhancing communication skills, accessing the general education curriculum, experiencing life and building self-esteem. The overall conclusion was that the success of inclusion seems to depend on the individuality of each child's needs and availability of resources in schools.

In summary, mainstreaming children with ASD into general education classrooms is important for developing social relationships and ability to socialise. School is where children spend most of their time after their homes; thus, it should be a place for reducing social and academic difficulties, which can be done through well-planned integration programs as well as the collaboration of all the education community.

Due to the importance of developing social and relationship skills in the life of children with HL, the issues of inclusive practice were discussed worldwide in the 1980s and 90s. Since HL students have some communication barriers, their ability to initiate and maintain a friendship needs more attention. One experimental study by Bowen (2008) questioned whether the co-enrolled classroom improved and increased HL students' friendships with hearing peers and their social interaction. Bowen (2008) noted that there was no difference between HL students and hearing students in social acceptance; however, hearing students in the co-enrolled classroom viewed HL students both positively and negatively while hearing students in the control classroom viewed almost all HL students negatively. Overall, this study showed that HL students in co-enrolled classrooms developed their ability to make friends, but the value of this friendship could not be certain. However, the study did not report some of the participants' information, such as the degree of hearing loss and social skills abilities. Also, the research did not have strong external validity because the intervention had been placed with HL only; in other words, it is uncertain

that they did not gain any other treatment that affected the result. In conclusion, since the researcher cannot be sure about the value of the friendship, and since there was not a significant difference between the normal classroom and the co-enrolled classroom, the effects of integrating HL students in the general classroom cannot be generalised or used to guide classroom integration strategies. These findings can be used to develop a better integration toward fostering relationships. Furthermore, in another study, positive attitudes toward HL students were shown by the majority of the hearing children but hearing students in classrooms that did not have any HL students had less positive perspectives (Hung & Paul, 2006). The social interactions produced positive attitudes toward HL students in the inclusive school. However, no study has identified how children with HL view the hearing children and how can they develop their relationship with them.

The second issue related to developing relationship skills is bullying, which is one of the unfortunate experiences that most children with ASD and/or HL face in schools, which might affect their life (Chilvers, 2007). Bullying is a form of aggression that can include direct behaviours, such as physical violence and verbal abuse, or indirect behaviours, such as spreading rumours (Hebron, Humphrey & Oldfield, 2015; Hebron, Oldfield & Humphrey, 2016). Bullying sometimes is considered to be a result of inclusion. Bullying has negative consequences on the psychological, emotional and educational aspects of children, affecting self-esteem, confidence, social relationships, trust, safety, and learning attitude.

Research in the UK stated that children with ASD are three times more likely to be bullied than other children, including children with other disabilities (Hebron et al., 2016; Humphrey & Symes, 2010). Another study noted that approximately 63% of young people with ASD had been bullied at school; this may increase to 75% in secondary school and may reach 82% of children with high-functioning autism or Asperger's syndrome (Bancroft, Batten, Lambert & Madders, 2012). In the US, 24.5% of students with disabilities (any disability) in elementary school, 34.1% in middle school and 26.6% in high schools have been bullied at some point; this rate is 1.5 times above the average for students without disabilities (Blake, Lund, Zhou, Kwok &

Benz, 2012). In rural schools in the US, the rate may increase. Females with a disability were between 3.9 and 4.8 times more likely to be a victim of bullying than those without disabilities; the rate for boys with a disability is between 2.4 and 3.2 higher than for those without disabilities (Farmer et al., 2012). Children who have been bullied are more likely to have negative perceptions of school, to have internalising and/or externalising behaviour problems, and to have a higher risk for behavioural and emotional difficulties (Blake et al., 2012; Farmer et al., 2012; Humphrey & Symes, 2010). Thus, bullying is a concern for all educators and parents because it might increase the risk of social exclusion. Hebron et al. (2016) find that behaviour difficulties increase children's isolation, which potentially makes them more susceptible to be bullied.

For children with HL, no study has been identified in the UK. A study in 11 US schools was conducted using a self-reported survey by Weiner, Day and Galvan (2013) to examine 812 students with HL regarding bullying. The result shows that children with HL are 2 to 3 times at risk of experiencing bullying compared to hearing students, and children with HL reported less support involvement by teachers or adults compared to hearing children (similar to the ASD research conducted by Humphrey & Symes, 2010). Some children with HL reported that they were disliked more than children with normal hearing. In the Middle East, Hussein (2010) developed a questionnaire to assess levels of bullying for typical developing children in primary schools, covering three countries, including a sample of 350 third to sixth graders from four elementary schools in KSA. The results indicated a higher level of bullying for Saudi children than American ones, and a higher level for boys than girls. This also indicates a problem in KSA schools that might impact children's social relationships and learning attitude.

As demonstrated before, bullying has negative consequences for the psychological, emotional and educational aspects of children, and may severely impact children's learning and mental health. Although bullying is considered to be a problem with educational placements, it can also be a problem in the online environment. Children who use online chat rooms or online gaming may also receive forms of bullying, such as verbal abuse or unauthorised access to private information. Thus, social,

educational and psychological interventions are required in both environments. Autcraft, for example, is an online game that has many junior and senior monitors to ensure players' safety, and this idea can be developed for other games. In general, having monitors in online and offline social interaction is not enough to reduce bullying (discussed in §4.6; i.e., Autcraft is an example of a safe server as the server is controlled and supervised by people with ASD; Ringland et al., 2015), and so many other interventions are needed.

2.8 Chapter Conclusion

In this chapter, a summary of the purposes of education (e.g., to develop individuals' social experiences through hands-on problem-solving) as an opening discussion on the importance of mental health and the needs of developing relationships with others for better well-being was presented. Many studies have found that children with ASD and HL have greater mental health problems, such as social and emotional difficulties due to the impact of the disability. These difficulties were discussed in regard to their impact on the well-being of children with ASD or HL. We are humans, social creatures, that have the desire and the need to engage with others, and shared understanding with others (intersubjectivity), so an introduction to how humans have the desire or need to engage with others was presented. A summary of the development of intersubjectivity and its differences with the theory of mind was then offered and followed by its state of development for children with special needs to provide better explanations of the root of social difficulties and the developments of social relationships. Afterwards, the development of relationship skills for children with ASD or HL was presented, with this section then concluding by providing a summary of some factors that may affect children's relationship skills besides mental health states. All these areas of discussion are important to this thesis, as the focus is on the development of relationship skills, which relies on engaging with others.

CHAPTER 3: DIGITAL GAMES

3.1 Introduction

Life has increasingly become technology-dependent, and people continuously use computers for many purposes, including pleasure and learning (Miller & Robertson, 2010; Paus-Hasebrink et al., 2019). Today technology, in fact, has influenced how contemporary children socially interact in pre-schools (Arnott, 2013) and early years' education (Miller et al., 2012). Digital games were first adopted for learning in the 1980s and 90s (Halverson, 2012), but their substantial application started from 2007. Digital games are very accessible to children today (Arnott, Palaiologou, & Gray, 2018; Miller & Robertson, 2011). Indeed, "childhood has changed, in part because children (and adults) now live in a digital age" (Arnott, 2016, p.331). The newest models of computers and technologies allow children to access the world of knowledge easier due to their interactive interfaces (Arnott, 2017). Recently, there has been considerable debate about the role of games and their benefits or harm to the learning process, due to the gap between the newer generation who use common technologies and the older generation who prefer hands-on learning and materials, which needs to be addressed through schools. Scotland supports the use of digital technology in classrooms, such as by promoting the national Digital Learning Week, which aims to "highlight and publicise the innovative and exciting ways in which digital technologies are being used to support Scottish learners" (Education Scotland, n.d., para 1). Consequently, the purpose of this chapter is to provide an overview of how and why digital games work in learning and social interventions in schools.

Children's play, in general, is engaging socially in the adventure of learning (Trevarthen & Delafield-Butt, 2013a). According to Mitgutsch (2008, p.26), "learning is a process of confrontation with resistant experience and knowledge that transforms the learners' experience, their pre-experiences, and their knowledge". Gee (2003) agrees that learning is a reflection of previous embodied experiences and offers a connection between different experiences. It is significant to study digital games because they provide useful and experiential learning, incorporating learning

principles or educational content into games to transfer new information or to practise learned experiences and engaging learners in the process (Mitgutsch, 2008; Gee, 2003, 2013), especially in technical and scientific subjects (Miller & Robertson, 2010, 2011). In the upcoming section, different methods used for digital games are discussed, though digital games and OCG are the terms used here. All these terms refer to games played electronically via a screen and an interaction machine.

3.2 Definitions

There are various terminologies related to digital games that need to be clarified.

Video games, according to Oxford Dictionaries, is "a game played by electronically manipulating images produced by a computer program on a monitor or other display" (n.d.). Video games can be used as a specified term for this study because MC meets the definition of a video game in this research, but it will not be used as it is culturally associated with subjective negative attitudes in the KSA. **Digital games** are "designed for profit and fun, but there's increasing interest in their use for non-entertainment purposes, particularly in education and training" (JISC, 2016, para. 1). 'Digital game' is a very wide term for all games that can be played digitally but has been commonly used in education. As in most of this section, the term 'digital games' will be used because it is a more common and comprehensive term.

Serious game is a term used to describe games designed for serious purposes. It refers to the new use of "gaming technologies for educational or training purposes" (Felicia, 2009, p.6). It is also defined as "any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed with the intention to be more than entertainment" (Ritterfeld, Cody & Vorderer, 2009, p.6). This term seems unfit for this research because MC was not designed for educational or training purposes.

Virtual worlds are another term that some research used to define some OCG based on its features. However, a virtual world should have "a synchronous, persistent network of people, represented as avatars, facilitated by networked computers"

(Bell, 2008, p.2). It is also defined as a "Multi-player (or multi-user) system which is presented as having large-scale geography. May be divided into game worlds and social worlds, the latter having no objective goals" (Egenfeldt-Nielsen et al., 2013, p.288). Similarly, **virtual reality** (VR) can be described as "a three-dimensional, computer-generated environment which can be experienced by a person [, and] the person is immersed within the virtual environment [,] and he or she is given the ability to manipulate objects or operate some activities" (Noor et al., 2012, p.579). VR is a playful, immersed multiplayer environment that allows players to experience an event represented as avatars. It supports role-playing within a safe environment, which allows the player to experience learned and applied rules. Virtual reality or Virtual worlds can be used to describe the world of MC, but I preferred not to use this term in this research because it is most common among academics, not parents and children, and because it mainly refers to a multi-user system where MC can be played individually. Using OCG as a term for describing MC seems to be simpler and clearer for parents and children as they are targeted in this research.

To summarize, digital games, video games and virtual reality are valid terms to describe MC and have been sometimes used to describe the features of MC; however, digital games and OCG has been used in this research to describe and clarify the discussion of using digital games. In this project, and for better consistent presentation, the term OCG is the most common term that is used as it is also used by parents and children and is used consistently within the literature.

3.3 Digital Games - Philosophically and Psychologically

First, it is important to clarify what is meant by learning. Prensky (2012) defined learning as a "set of processes people employ, both consciously and unconsciously, to effect changes to their knowledge, capacities and/or belief" (p.38). His statement admits that several things are related to learning; it has to be done with the learners where learning involves knowledge, belief and doing. Thus, the game does not hold the ability to teach something by itself but engages and motivates learners to be a centre of the learning (Mitgutsch, 2008). People have different learning styles. Better

learning occurs when multiple senses are involved, by engaging in challenging activities, observing other people, doing and experiencing (Prensky, 2001). Digital games are able to provide the characteristics of better learning. According to Felicia (2009, p.10), in the "cognitivist theories, subjects possess an internal map (knowledge), which external events will require them to update". Learning follows the requirement of the "external" world, and games offer learners the opportunity to experience the "external" world. Learners can modify their internal map more easily based on the immediate feedback that they receive through the game or their previous action within the played game.

A philosophical perspective introduces a new aspect of learning through digital games. Idealists highlight the importance of learning a new concept and ideas. They also believe in sharing universal ideas. Philosophy provides insights into a non-linear and circular process of learning and relearning new ideas, merged with the unstructured and spontaneous aspect of play in learning games (Kolb, 1984). Factors of realism and idealism are also identified in digital learning games such as perceptual pervasiveness, simulation, character involvement, social realism, authenticity regarding subjects and characters, and freedom of choice.

Digital games provide supportive methods of learning where the focus goes beyond memorisation. Bloom's Revised Taxonomy ranks and positions the forms of thinking in education as: creating, evaluating, analysing, applying, understanding, and then remembering (Krathwohl, 2002). The highest form of learning is what is involved in creating something new, such as building the structure, pattern or meaning, while understanding requires the lowest form of thinking because its goal is to recall or retrieve previously learned information. In terms of digital games, some of them enable players to create new things or evaluate the value of ideas or materials. Hence, digital games provide players with the opportunity to practise great forms of thinking. According to Trybus (2016), learning through digital games exceeds memorisation, which is the focus of traditional teaching. It helps players to acquire appropriate skills and thoughts that are needed in many situations.

According to Egenfeldt-Nielsen et al. (2013), George Herbert Mead (1863 - 1931) was a social psychologist who thought the play was an essential element of formulating the self. He thought social activity comes through communication because “humans use a shared system of symbols to exchange ideas with each other” (p.36). Playing, for him, is a symbolic system of communication. He defines play as a way that children pretend to be another person or another thing, but “the player needs to be conscious about the other players’ roles at all times”; thus, “to go from play to game requires the individual to integrate himself into a higher level of group organization” (p.36). Furthermore, Egenfeldt-Nielsen et al. (2013, p.36) stated:

> Games are excellent mirrors of the way that people organize themselves, where all actions are related to each other in an organic way that can be understood by learning the rules. Children experiment with many different kinds of social organizations as they grow up. The exercise of learning to belong, of learning different roles and rules, allows their personality to develop.

As can be seen, the play is a form of communication that has many cognitive and social advantages. It develops players’ understanding of others, which is significant for learning and socialising, as discussed previously in the intersubjectivity section.

Psychology also has studied learning over the past century, and digital games are in line with the learning theories. According to behaviourist philosophy, teaching should emphasise exercises as a means of increasing desired behaviours, and progress learning through changes in behaviours (Groff et al., 2010; Mitgutsch, 2008). It insists on the association between neural impulses and sensory experiences through trial and error (Felicia, 2009), and digital games can be designed to increase desired behaviours. As such, it builds students’ confidence and creates an understanding that there is always room for improvement. Behaviourist philosophy insists that increased access to digital learning games strengthen neural connections, consequently enhancing learning (Wardlow, 2014). Besides, educational games increase students’ access to learning tasks designed around operant conditioning, where players voluntarily respond to the game actions based on their expected consequences, such as games that reward players with tokens for correct responses (Wardlow, 2014).

Based on Social Cognitive Theory (SCT), observing plays an essential role in learning (Bandura, 1992), and the best learning occurs when learners are able to observe, model and imitate the learned task multiple times (Bandura, 2009) and when self-efficacy is encouraged, and when learners can be faced with tutoring and mentoring (Ormrod, 2011; Wardlow, 2014). The SCT mainly aims to explain learning that takes place in a social context through observations, discussions and sharing (Bandura, 1992), where learners can learn from each other, such as by observing or imitating other players (Reeve, 2012). Through digital games, teachers are able to provide learners with multiple models, and this may explain why some studies concluded that exposure to video game violence is more likely to result in higher levels of aggression (Anderson & Bushman, 2001); therefore, proving children can model and imitate good behaviour or learn a specific task through playing games and interacting with others. Self-efficacy can be defined as the belief about one's ability to fulfil or achieve goals, or the goals that individuals make for themselves (Bandura, 2006).

Self-efficacy, which has shown some effect on behavioural outcomes as people make more challenging goals when they have higher self-efficacy (Bandura, 2004), can be developed when a player achieves their goals through practical experience. It can be built through observational learning (Starks, 2014). Finally, learners could connect with their tutors and mentors online (Wardlow, 2014). Based on the concepts of the SCT on mass communication (Bandura, 2001), media, which proposed to be applicable to digital games, can also be the role model for children and young people because a game "can either facilitate real-life relationships if it is played with or discussed with others, or can provide direct models" (Starks, 2014, p.3). Thus, digital games can provide learners with great models based on the Social Cognitive Theory perspective of learning, although the cognitive experience has an effect on any consequences that will result (Nowak, Krcmar & Farrar, 2006).

Information processing theory is another learning theory that focuses on learners' attention, perception, encoding memory, accumulating knowledge in memories, and being able to retrieve knowledge (Wardlow, 2014). These abilities are critical to developing learning and implementing learned skills. Thus, digital games provide

learners with the capacity to strengthen the process of learning through a specific task in the game, where they can apply these processes to learn or practise a skill.

Vygotsky's Zone of Proximal Development (ZPD) stated that learners should be skilled independently in problem-solving techniques. Vygotsky sees interaction with peers as the most effective approach to developing personal and learning skills and strategies (Ormrod, 2011). Vygotsky stated "a child's greatest achievements are possible in play, achievements that will tomorrow become his basic level of real action and morality" (Vygotsky, 1978, p.100); and "the essence of play that a new relation is created between the field of meaning and the visual field-that is, between situations in thought and real situations" (Vygotsky, 1978, p.104). He also emphasised that "what a child can do in cooperation today he can do alone tomorrow" (Vygotsky, 1986, p.188). Thus, games play an important role in children's social development.

Halverson (2012, p.436) stated, "Game worlds display many of the features that shape everyday social interaction". Social interaction involving problem-solving techniques can be practised in digital games because players' independence and meta-cognitive skills improve through play and interaction. Progressing in most digital games requires players to engage with the environment, including other players. Thus, the "ability of digital games to engage children and motivate them to learn in order to succeed is by far the most interesting feature that could help instructors to make learning a more engaging and motivating activity" (Felicia, 2009, p.12). The main aspect of social learning is intersubjectivity, where learners share the meaning of their interaction and the world (Delafield-Butt & Trevarthen, 2013). Thus, digital games develop social interaction through a shared understanding and the ability to solve problems, which are essential for everyone and are lifelong skills.

To summarize, Prensky (2001) demonstrated that there are many ways in which people can learn, including feedback, reflection, failure, mistakes and models. Digital games can offer these things to players because players experience games similar to an experiment. Digital games have been used to employ, demonstrate and raise awareness of something among students (Felicia, 2011a). Opponents of digital learning games argue that these games are distracting and go against the learning

goals of the classroom. However, games help learners develop essential intellectual and emotional skills that enhance the process of achieving academic goals. In education, games are used for developing academic learning through social interaction, which trains students' social skills and improves their teamwork.

3.4 How Do Games Work in Education?

According to the Curriculum for Excellence (Education Scotland, 2016), using technologies, including digital games, in learning allows learners to be skilled, thoughtful and flexible citizens. Pupils can learn how technologies can influence societies and become confident to use technologies in their future life. Technologies may allow them to contribute to a better world to improve their lives, others' lives, and the environment as well as to be able to make logical choices for the environment and in ethical, economic and cultural issues. Consequently, in order to improve learners' lives, digital games should support learners to develop these skills.

The key goal of implementing digital games in an educational setting is to progress learning, and offering a pleasurable, engaging and safe environment for learning, as well as allowing players to explore, practice, refine or create a particular task that would lead to developing or improving personal or educational goals (Arnott, 2016; Prensky, 2001). Digital technologies have efficiently and proficiently assisted in transforming educational content to children, and therefore, children have responded positively to using them in their setting (Arnott, Grogan & Duncan, 2016). Thus, good digital games should give players the freedom to explore, experiment, fail, progress and choose the proper method to achieve the designed goal. In addition, individual learning can come through problem-solving skills in some digital games by offering players a safe environment to practise their problem-solving skills (Ke et al., 2019; Trybus, 2016), where players would be able to retrieve the experience when they face a similar issue in real life. Further, digital games have similar features to physical games, but more digitally. Some digital games have been designed effectively to attract players to progress, to be more modern, and to meet the needs of the new and technological generations. Conversely, traditional learning tends to

involve passive approaches that use certain procedures without challenging learners' level of thinking (Trybus, 2016). However, the challenging part of designing digital games in education is how to make them accessible to all students, regardless of their abilities or background, and attracting students' attention (Trybus, 2016).

According to Slota (2014), digital games provide learners with different learning than traditional toys because of their immersion in the experience of building things that are not possible in the playground. In digital games, players can direct their learning, make choices and test the consequences. According to Felicia (2009, p.10), "players can elaborate new theories and hypotheses, test them and readjust their knowledge and skills accordingly". Players in digital games also benefit from imaginary worlds that can help them to explore different things using problem-solving skills, such as scientific or biological content, which they cannot explore in the real world (Slota, 2014). Consequently, digital games can provide learners with an accessible and safe environment to explore and experiment with things that they cannot access the real world or in physical games (Ringland, 2019). Likewise, according to Felicia (2011b), there is much evidence that OCG can be more effective in teaching students skills compared to traditional methods, as they provide meaningful and accessible lessons with more engagement. Students should be at the centre of their learning, and they learn through action and experience whereas, in the traditional methods, learners grow by listening and have less chance to repeat experiences. Thus, Felicia (2011b) argues that teachers should be aware that games cannot be used as an independent application, but to support learning, keeping in mind their limitations.

Players' interactions in OCG were reviewed in some studies. Caroux et al. (2015) conducted a systematic review of 72 articles that deal with human-computer interaction to examine multiplayer games. They found that online multiplayer gamers were driven mostly by social enjoyment, and that games have an impact on players' experiences depending on the type of game and whether it is competitive or collaborative, players' immersion and emotion, and level of motivation and social interaction. Also, Boyle et al. (2012) systematically reviewed engagement in computer games through the subjective experiences and enjoyment of games and

motivations for playing games. Players mainly play for pleasurable experiences or enjoyment, but some players may play for other reasons such as escapism, avoiding boredom and depression. But, enjoyment was one of the main reasons for playing and will lead to positive attitudes and expectations of games (Boyle et al., 2012).

People tend to prefer what they can engage in. Digital games can be useful in learning outside school, such as through developing trial and error and progressive linear models as well as through learning to learn and to participate in practice (Kirriemuir & McFarlane, 2004). Digital games provide players with entertainment that motivates them to continue the game. Consequently, if these games are used for learning purposes, this would provide learners with entertaining learning. Learners are not only given interesting facts but also can experience how and why this fact is important (Trybus, 2016). As previously stated, digital games are similar to books and school materials that should be used for supporting and maintaining learning, but they have certain differences. For example, Gee (2013) differentiated that books have content that should be understood, whereas games are based on problems that need to be solved. Learners may find it easier to design a game for learning purposes or to be a co-author of the game, by choosing certain features, than to write a book, so producing learning is different via these two methods (Gee, 2013). I would emphasise that these differences do not always make one method better, rather than each learner has their own preference for learning.

Prensky (2001) mentioned some cognitive style changes within the games' generation. The games generation can parallel-process information quicker and better, by doing more than one thing at the same time and become more active in their learning to approach designed goals instead of following fixed instructions. The games generation have a good chance to be connected worldwide through these games, which helps them to think differently and be more open to ideas. Also, players can receive the rewards or the 'payoff' immediately, which increases motivations. Additionally, this generation considers games as a friend with whom they play, relax and have fun (Prensky, 2001). Furthermore, Bossavit and Parsons (2018) inferred that cooperative games might allow children to be aware of each other and encourage

positive collaboration between the students. Thus, OCG can be considered as effective tools for academic and social learning.

What makes digital educational games different is that they “not only engage the learner by entertainment and challenge, but by confrontation and passion” (Mitgutsch, 2008, p.31). Educational digital games are not a tool for transferring content but provide an engaging and entertaining environment. As Mitgutsch (2008, p.31) concluded, the "virtual environment itself, with its own culture, its specific social aspects, its horizon of experiences with its implicit knowledge and beliefs, and with its drive to confront the learner’s prior experiences, appears to be the vital key to enriching learning". Therefore, OCG may be defined as an educational tool that can be used to cultivate involvements and interactions.

The Scottish Government report (2015) reviewed several studies and concluded that the use of digital technologies is a useful tool to overcome learning challenges or to reduce the gap in knowledge and understanding for students with disabilities or from disadvantaged backgrounds (see p.26 in the cited report for an in-depth discussion of these studies). These studies concluded that digital tools are useful to reduce learning gaps between students. However, according to the Scottish Government report (2015), no research has studied the difference between age group and gender usages of digital technology, instead with these assuming to have similar outcomes. Hence, teachers and educational game designers should consider the age and gender relevance to the game, and future research needs to consider this.

Teachers have a variety of reasons for using digital games in classrooms. For example, Wastiau et al. (2009) found almost 27% of teachers use digital games in the classroom for motivation, 24% for contributing to educational objectives, 13% for promoting right values, 11% for promoting social skills and joint learning, and almost 3% for promoting creativity. Teachers also have a variety of expectations from games, such as flexibility (21%), validity for content and information (16%), easiness to be understood and used (16%), easiness to be installed without technical problems (14%), good didactics and feedback (13%), fun (8%), professionalism (8%) and low cost (6%). Likewise, digital games have been used in a variety of subjects, which

proves that they should be used as a supportive tool. Wastiau et al. (2009) stated that 30% of the use of digital games in the classroom was undertaken in the teaching of technical subjects, 20% for teaching a foreign language, and the rest in teaching other subjects. Importantly, only 13% of teachers reported that the purpose of using digital games in the classroom was for students with special needs, although several teachers thought it would be beneficial for all learners. Thus, the usefulness of digital games among children with special needs has been determined by academics and policymakers (Wastiau et al., 2009). For this purpose, this research hypothesises that games would be socially supportive for children with ASD or HL.

Teachers and players have specific roles in digital games. Teachers should clarify the purpose of using a digital game in the classroom and give clear instructions about the task, explaining why this game has been chosen and how it will support their learning (Felicia, 2009), as well as the game's relation to academic theories. Students, meanwhile, are expected to comprehend how the games operate, how they relate to learning, and to explore the game based on the task. Finally, it is critical to have a debriefing session where learners connect what they have done in the game and the learning objects (Felicia, 2009). Overall, the aim of using digital games in learning should be to "make every learner a proactive, collaborative, reflective, critical, creative and innovative problem solver; a producer with technology and not just a consumer; and a fully engaged participant and not just a spectator in civic life and the public sphere" (Gee, 2013, p.1). Change can be made once educators and students work collaboratively to achieve these features of learning through the games.

3.5 The Positive and Negative Attributes of Digital Games

Digital games are a form of technology, so there are some possible advantages of using them in the classroom. Arnott (2017, p.14) states that "through open ended play and fun, carefully framed, scaffolded and supported experiences, children can have enriched technological journeys". In addition, according to the Curriculum for Excellence: Technologies principles and practice (2016, pp.2-3) in Scotland Education, well-designed and implemented activities can develop the following skills in learners:

curiosity and problem-solving skills; planning and organisational skills; creativity and innovation; skills in using tools, equipment, software and materials; skills in collaborating, leading and interacting with others; critical thinking; discussion and debate; searching and retrieving information; making connections between specialist skills; evaluating products, systems and services; and presentation skills. These technological principles developed in Scotland are mostly applicable to digital games.

Connolly et al. (2012) conducted a systematic literature review of 129 papers on computer games and serious games to examine their potential positive impacts on users aged 14 years or above. They concluded that playing computer games is associated with a range of perceptual, cognitive, behavioural, affective and motivational effects. Knowledge acquisition, content understanding, and effective and motivational outcomes were the most common outcomes. Also, Boyle and Boyle (2014) reviewed the relationship between executive functions and learning outcomes from serious computer games and concluded that designing games to assess specific cognitive functions might develop our understanding of executive functions and provide rehabilitation opportunities for individuals with special needs. Computer games-based training that targets working memory and inhibition might lead to short-term developments in executive function scores (Boyle et al., 2016).

Digital games were reported as more effective in learning than traditional ways of learning and psychological development. Clark, Tanner-Smith and Killingsworth (2015) did a meta-analysis to analyse 69 studies with a total of 6,868 participants on digital games and learning for K–16 students, aged between 6 and 25. Results of this meta-analysis show that digital games were more effective than non-game instruction of learning. Additionally, digital games improve interpersonal learning outcomes, including motivation, diligence, positive self-evaluation and intellectual openness. However, there were no indications of an impact on the game duration and the outcome of learning. Importantly, single gameplay sessions did not exhibit different learning outcomes, but multiplayer gameplay sessions show significantly enhanced learning outcomes compared to the control condition. The researchers noted that competitive single-player games were less effective in learning.

Digital technologies have a strong relationship with producing and distributing knowledge, and they have six significant benefits over traditional learning methods. They motivate players to engage in the task and follow the learning instructions (Trybus, 2016). In addition, digital games have been found as cost-effective and low-risk methods for teaching some concepts and help players to apply their learning to the real world because it can be in a similar environment offering a safe environment of interaction (Trybus, 2016). Also, Kirriemuir and McFarlane (2004) stated seven positive outcomes of using games in the classroom: strategic thinking, planning, communicating, applying for numbers, negotiating, group decision-making, and data-handling skills. All these skills are vital to education as learning is participatory and should be sustained through active engagement and participation between the learner and the world around (Baldwin, 1894, 1906; Piaget, 1953, 1962). Also, Squire (2011) argued that using digital games involve the users in the participatory culture, encouraging systematic thinking and experimentation. In fact, digital games not only have advantages for social, communication and academic skills but also support the development of motor, cognitive, spatial and emotional skills such as self-esteem and self-confidence (Felicia, 2009) and relieving stress (Wack & Tantleff-Dunn, 2009).

There are a variety of emotions that players may experience, such as “joy, empathy, anger, frustration or triumph”, which develop players’ learning, “especially if the emotional content or tone of the material to be learned matches the emotions of the learner” (Felicia, 2009, pp.8-9). Also, Burnett (2016) inferred that using digital technologies involves skills related to social, emotional, cultural, financial and political conditions. Thus, the association between digital technologies and changes in social and cultural practice will influence learners of the new generation. Computer games teach a player to learn about themselves as learners and experience the subject as embedded in the cultural environment (Mitgutsch, 2008).

On the other hand, some researchers claim that games destroy learning processes (Felicia, 2009). There is a huge debate among scholars about whether digital or computer games “increase aggression or that games provide a release for pent-up aggression”. This debate cannot be entirely resolved due to the variety of games and

how each player deals with them (Kirriemuir & McFarlane, 2004, p.3). However, as Prensky (2006, p.5) stated, “The true secret of why kids spend so much time on their games is that they’re learning! And what they’re learning is important to their future.” This does not mean the use of digital gaming is useful for the learner’s future only; in fact, “there is a need to explore the significance of the digital age not just in terms of preparing children for an uncertain future, but in ensuring they are confident, safe and discerning users of digital technologies now” (Burnett, 2016, p.3).

Chee (2007) argued that there is no direct link between violent games and aggressive behaviour; thus, it is not wise to stop using games in the classroom due to a hypothesis that has not yet been fully proved. However, Greitemeyer and Mügge (2014) did a meta-analytic review of video games and the effect of violence and social outcomes using data from 98 experimental, correlational, and longitudinal studies with 36,965 participants. The review found a significant association between violent video games that expand aggressive behaviour and reduce prosocial outcomes, while prosocial video games decrease aggression and increase prosocial outcomes. This study clearly shows the relationship between video games and players’ social outcomes. However, this meta-analytic focus was on the violence of video games, which is debatable in some games, e.g., Minecraft, as the ‘violence’ can be reduced through modes and it is known as a cooperative game.

Some researchers argue that computer games may displace other physical activities (Kirriemuir & McFarlane, 2004). Al-Dossary et al. (2010) were concerned that some children in KSA have become less active as they play computer games for six hours daily on average. However, according to Sheehan and Katz (2012), players of computer games are more likely to be able to blend technology and physical activity. They stated that: “the more opportunities provided for children to play in the zone, the greater the likelihood that they will develop a positive attitude about physical activity and develop the confidence and desire to be active for life” (p.64). Wack and Tantleff-Dunn (2009) examined whether the frequency of electronic game playing is linked to obesity, social or emotional status, and academic performance among 219 college males. There was a significant positive correlation between the frequency of

play and social or emotional status, and gaming provided the students with a healthy source of socialisation and stress relief. Importantly, the result shows no significant relationship between the frequency of play and body mass index or average grade point, arguing that games do not cause obesity.

There is also an argument that most OCG were made for a certain race and gender, so students from minorities specifically are not able to fully participate in the process of making or choosing the game that would be used for their learning. For example, there is a lack of women in game design (Peppler & Kafai, 2007; Squire, 2011; Southgate et al., 2018). This could reduce some students' learning benefits from the game, especially with special needs. However, an alternative perspective illustrates that discrimination or having certain privileges over others undoubtedly exists in school and the whole of the education system regardless of the use of digital games. What this idea can teach us is to involve all learners in the design, implementation and application of digital games to help provide an equal and fair environment.

Indeed, the stereotypical debate on digital games seems to be based on a few games. It should be noted that there are a huge number of computer games that are very different from each other. For instance, Burnett (2016) reported a lack of research about the impact of technologies on children's learning and well-being. Some researchers claim that there is a risk from using technologies, but this risk has not been supported by enough evidence. Indeed, "New media can provide children with innovative and engaging learning experiences and allow them to be empowered and connected in new and exciting ways through digital technologies" (Gillen et al., 2018, p.3). From my viewpoint, there is a level of risk or safety concern about digital games, but I think this level of risk exists in the offline world as well, so teaching children to be cautious is necessary regardless of using online or offline games. Nonetheless, the focus of today research should be more on how digital technologies can be used for purposeful and useful practices (Arnott, 2016). Overall, similar criticisms could also be applied to books and movies. Teachers should receive training and funding to be able to choose games with a limited number of side effects and to be able to modify any game to be suitable and safe for all students.

3.6 Digital Technology in a Cultural Context

Te Whariki is New Zealand's early childhood curriculum which is a policy statement advocating providing children with early learning and development within the sociocultural context (Lee, Carr, Soutar & Mitchell, 2013). This curriculum has five main sectors: well-being, belonging, contribution, communication and exploration (Lee et al., 2013). These categories contribute directly to the child's learning and development. Play contributes to the important aspects of a child's emotional and physical well-being by creating a feeling of belonging to society, providing a space for contributing and participating in learning and being able to communicate as well as explore the environment. This approach emphasises the importance of play in providing meaningful learning (Lee et al., 2013). Minecraft, as a digital game, commits to such standards: it has been used in research to engage children and allow them to explore the environment using virtual reality techniques.

Finland's educational system is one of the world's leaders in educational outcomes. It focuses on less classroom-based teaching as learning has become more accessible through digital devices, and because "less teaching can lead to more students learning if the circumstances are right and solutions smart" (Sahlberg, 2011, p.141). There is a focus on learning through play, which might be driven by the curriculum. This focus on playful learning and teaching aims to develop and improve learners' creativity through collaborative (not competitive) and enjoyable (not accountable) learning (Sahlberg, 2011). Minecraft, indeed, complies with almost all Finnish educational principles, focusing on collaborative (not competitive) activities and providing more accessible, participatory learning tools.

The Scottish Government (2015) reviewed 217 studies on the use of digital technologies and games for learning and teaching, concluding that there is definite evidence that digital resources increase learning depth and speed for primary and secondary school learners, reduce inequality and help learners with special needs to reduce the learning gaps with others. Furthermore, digital technologies evidently can: enhance parents' engagement with their children and the school; build collaborative, interactive and leadership skills as well as critical thinking for secondary

schools' learners; and improve the efficiency of the educational system. The Scottish Government report (2015) emphasises the importance of having sufficient accessible tools, training and supportive networks for teachers and learners besides having flexibility in learning and teaching. The report critically mentioned that most of the reviewed studies focus on short- and medium-term outcomes, and was commonly conducted qualitatively, where quantitative studies tend to be conducted over a short time. Thus, there is no guarantee that digital tools will have long-term outcomes, but there is enough evidence that they are very useful for learners.

Learning and Teaching Scotland (LTS), in partnership with Futurelab, examined the educational advantages of console games on learning in 19 Scottish schools (Groff, Howells & Cranmer, 2010). The major findings are that games: give students and parents an excellent opportunity to engage in activities; raise teachers' motivation; reduce the cultural gap between children's home and school; and students report that many games have benefits, such as increasing collaboration, creativity and communication. The researchers indicated that games need to be well planned, designed and prepared to fit well with the curriculum and teachers and learners need to be supported throughout the implementation of the game. Schools have some difficulties with resources, or some teachers do not have enough experience with the games, and these difficulties need to be reduced. More incorporation with other teachers is recommended. Projects and activities should not be repetitive or a distraction for other students. Finally, leaders are recommended to increase support and encouragement to apply game-based learning approaches (Groff et al., 2010). Indeed, using digital games improve students' attitude towards school (Miller & Robertson, 2011). Therefore, the UK policy on digital games in classrooms supports the claim that games improve students' critical thinking and the development of new teaching techniques, for instance, through solving puzzles and challenges.

Although there are very few studies on the use of technologies or games in KSA, it seems that they have been mainly used individually and that computer games seem to be very widespread among youth there. Mashat, Wald and Parsons (2016) investigated and observed the use of social media by six people with ASD in KSA to

understand the role of technologies in adults with ASD lives. The result shows that individuals varied in terms of the skills, awareness and independence regarding the use of social media as well as in the different reasons, such as chatting, sharing videos and photos or for educational purposes. Some individuals reported that social media had helped them to enhance relationships and friendships as well as communicating with others. The researcher noted that the use of social networks was associated with caregivers' beliefs and restrictions which highlighted the cultural and familial rules.

It was found that only one study has been conducted in KSA regarding video games. Mortada et al. (2016) conducted a cross-sectional study in Jeddah for 407 children aged 2–17 years old to assess the impact of video games on nocturnal enuresis, physical activity, and school performance. They reported that children spent more than four hours daily playing computer games. Researchers also stated that 90.4% of children who had grade A at the school reported playing video games; and 95.4% of children who engaged in physical activity reported playing video games, whereas 100% of children who did not engage in physical activity play a video game.

Marshall, Gorely and Biddle (2006) systematically reviewed 90 studies to estimate the prevalence of screen-based media use and reported that 18% of youth play computer games for more than four hours a week, around 40 minutes a day; 30% of boys played computer games compared to only 7% of girls. In terms of the country where players in the included studies played computer games, the results show that 20% were from Canada, 18% from European countries, 18% from the US, and the rest were not mentioned. Estimated time of playing computer games was consistent across countries. However, the publication data range in this review was very wide (1949 to 2004), included some outdated studies, and did not mention participants' ability condition. More recently, Wastiau et al. (2009) conducted a study in eight European countries: Austria, Denmark, France, Italy, Lithuania, the Netherlands, Spain and the UK, using a questionnaire for more than 500 teachers and interviewing more than 30 experts and political decision-makers. The result shows that teachers need to know more about using games as teaching tools regardless of their age, gender, subject, years of experience, level of games familiarity, and whether they

already use games. Their main obstacles were how to relate games to the curriculum, lack of equipment, and other teachers' and parents' reticence or caution. Over 80% of teachers thought that digital games have a place in schools, while less than 10% thought digital games do not belong in schools.

3.7 Digital Games for Children with Special Needs

Computer-based interventions, including digital games for children with ASD, have shown some positive outcomes for developing social and communication skills (Hedges et al., 2018; Parsons et al., 2011). Children with ASD or HL play differently than TD children or children with other types of developmental delay (Frost, Wortham & Reifel, 2012). Children with ASD usually struggle with symbolic play (Frost et al., 2012), which might be due to the lack of social contact and peer interaction or language skills that make their play rigid and unimaginative (Wolfberg et al., 2015). Grynszpan et al. (2014) did a meta-analysis of technology-based intervention studies for children with ASD, including computer programs, virtual reality and robotics studies. The result shows that there was significantly different overall effectiveness of technology-based training for post-tests of controlled studies; thus, the results of the meta-analysis support the use of technology-based intervention for continuing development, evaluation and clinical usage for children with ASD, and importantly, dealing with the social and sensory difficulties that children with ASD may face in traditional classrooms (Tsikinas & Xinogalos, 2019).

Parsons et al. (2017) presented an overview of the main discussions with multiple scholars across the UK from seven seminars entitled, "Innovative technologies for autism: critical reflections on digital bubbles", between November 2014 and November 2016. They reported that digital technologies were seen as "bridges" for interactions between people, sociality, disciplines, with or without ASD and can be helpful in the following: allowing people to understand and experience different perspectives and cultures; allowing individuals to make online connections and friendships; and raising awareness of ASD among other individuals.

Mazurek et al. (2012) investigated the use of screen-based media among a large sample of 13 to 17 year old youths with ASD (n=920), speech and language impairment (n=860), learning disability (n=880), and intellectual disability (n=850) for comparison with ASD. The result shows that 41.4% of youth with ASD spent most of their free time playing video games, and there was significantly greater use of video games with youths with ASD than youths without ASD. Interestingly, the study did not find any differentiation between people with ASD who spent most of their time playing video games, and those who did not spend most of their time playing, in terms of social interactions or communication. However, this study did not have a pre- and post-test of the social interactions or communication, so students may not show any differentiation due to other uncontrolled variables. A further study examined the use of video games among children with ASD (n=202) compared to a TD sibling (n=179) (Mazurek & Wenstrup, 2013). The results show that children with ASD spent significantly more time on video games than children without ASD. Boys with ASD spent an average of 2.4 hours per day while TD boys spent an average of 1.6 hours per day. Girls with ASD also spent more time on video games than TD girls (1.8 vs 0.8 respectively). Hence, children with ASD use video games more than other children, and therefore, educational intervention through these games might be helpful.

According to Parsons and Mitchell (2002), VR is a developed and factual environment that has many advantages for teaching social skills: ease of use and availability for children, ability to practise role-playing, motivating learning, and allowing players to practise social interaction where it occurs between avatars and objects or ideas. Parsons et al. (2009) reviewed 34 studies to examine the use of VR among children with special needs. Although most studies have some sample sizes and generalisability issues, the reviewers found that children enjoyed completing tasks in VR and were less distracted. However, according to Parsons and Mitchell (2002), interacting with VR may promote withdrawal behaviours from the real world. Also, generalising what is learned in VR to reality is still a concern that needs to be addressed (Parsons, Newbutt & Wallace, 2014). Parsons and Mitchell (2002)

suggested that virtual reality should be used with other interventions to increase learning and generalisability as well as interacting with others in the real world.

Children with ASD might be able to conceptualise themselves into their avatar within OCG (avatar is an icon or an object that is used visually in online games or a virtual world to represent a person on the Internet and computers). Stendal and Balandin (2015) undertook a case study to investigate the use of virtual worlds, focusing on Second Life, by people with ASD. The results suggest that people with ASD feel more comfortable communicating and interacting in virtual worlds than in the physical world because they have the chance to establish and foster relationships and friendships. The interviewee expressed that he developed a relationship with his avatar because he considered it as a representation of self. Virtual worlds are preferred for people with ASD because they are not dependent on social cues, which might be a limitation of physical interaction (Ringland, 2019).

Serious games are reported as useful for social and communication skills of children with ASD. Anzulewicz, Sobota, and Delafield-Butt (2016) reported that gamification is important for autism assessment, as it illustrates how games can be used in 'serious' contexts to give significant advantages for children with ASD; i.e., they are attracted to play the game and they have fun doing it, and we can, therefore, provide games that give positive outcomes, for diagnosis for social skills development in the case of MC. Furthermore, Zakari, Ma and Simmons (2014) reviewed 40 serious games that were designed for people with ASD published between 2004 and 2014. Forty-four percent of these games resulted in an improvement of social and communication skills, and most of the serious games were designed for educational purposes. Also, some games were designed to assist the social interaction between ASD and TD children, such as PRISM, which was designed to help TD children to empathize with their ASD peers and to play and facilitate social and communication interaction (Ramesh et al., 2018). Thus, studies have shown a positive effect of playing serious games. These help students with ASD to engage with others and express their feelings.

For children with HL, the most affected problems in play are the language and communication problems (Frost et al., 2012). These difficulties placed more barriers to the sophisticated level of play compared to hearing children, especially for children who are not integrated with hearing peers in the same classrooms. Musyoka (2015) observed 22 play sessions of a 4-year-old deaf child who is native in American Sign Language in a bilingual classroom using Play Observation Scale. The research found that the child engaged in different play behaviours with different play partners. The child was capable of engaging in most of the developmentally appropriate play behaviours similar to hearing peers. The most influential factor in her play behaviours is a teacher's leading and control of play in the classroom (Musyoka, 2015). Although this study was not on computer games, it demonstrated the importance of play on the lives of children with HL and the importance of teachers' regulation to the play behaviours in the classrooms. Thus, children with HL may also use serious games for easier communication and interaction with other children.

Luckner and Movahedazarhouligh (2019) conducted a research synthesis of all social-emotional interventions with children and youth who are deaf or hard of hearing. The researchers reported that only three studies addressed group play, cooperate and interact with other players in a positive manner (Antia & Kreimeyer, 1996; 1997; Ducharme & Holborn, 1997). Luckner and Movahedazarhouligh (2019, p. 5) reported,

> All three studies reported increases in the social interaction of the children who were deaf or hard of hearing and suggested a need to augment the frequency and the intensity of the social skills intervention and the systematic generalization of those skills across settings, activities, and people".

Children with HL may also benefit from VR. Passig and Eden (2000) studied the effect of VR on the flexible thinking of 44 children with HL using an experimental research design. The results indicate that VR significantly improved flexible thinking in the experimental group. Indeed, children with HL accomplished lower scores in flexible thinking before the experiment than children with normal hearing; however, after the experiment, the VR decreased the difference in flexible thinking between children with normal hearing and children with HL. Another study examined the efficiency of

an early intervention program to develop children's sequential time perception within virtual versus graphics training for 65 children with HL aged 4–7, using a pre-test and post-test measures (Eden & Ingber, 2014). The researchers concluded that both groups showed significant development in sequential time achievement, and the enhancement is more significant in the VR group.

Regarding academic achievement, Vogel et al. (2006) conducted a quasi-experimental research design to determine if previous findings can be generalised to non-simulation-based game designs and concluded that deaf children show a significant improvement in math skills but exhibit no improvement in language arts skills. Researchers suggested that a simulation-based approach to VR should be combined into the gaming technology and that, although learning games are useful technologies for learning, the design of games should be personalised to afford an attractive and inspiring experience.

Yi and Kim (2015) used surveys to find whether serious games would help people with HL to develop their auditory skills as they face numerous social and communication difficulties due to hearing loss. The results of using this game show it as being more effective than using the traditional training (85%), with satisfaction rated at 92%. Only 1% of the participants found the game inefficient, and no-one reported dissatisfaction at using the game for auditory training. Although this study was done on auditory skills, digital games can be helpful for supporting social skills as well.

3.8 Chapter Conclusion

Many digital games attract the attention of students from differing demographic backgrounds and stimulate learning and enable them to accomplish their goals. OCG is interactive in nature; hence, it stimulates learning and motivates learners to tackle new knowledge or topics. Children's engagement with others, ideas or things require some advanced skills, such as self-regulation, arousal and attention (Delafield-Butt & Adie, 2016; Savina, 2014); these advanced skills can be practised through digital games. OCG is a method for facilitating communication and interaction between the learners 'players' and learning content 'knowledge and facts'. Yet, another angle on

this debate suggests that there is not enough evidence that digital games are substantial for learning. The concerns were clearly made due to the lack of experimental and controlled research conditions, which cannot be fully met due to many social and cultural factors. As a result, it is hard to generalise such a single statement about computer games in learning or whether they are good, bad or indifferent. Their effectiveness should be judged based on what game is played and the context in which it is used. In fact, most of the current research criticised that "Instead of focusing on the unique affordances of game design and gameplay, many games researchers instead have focused on defining games in terms of existing education research agendas" (Halverson, 2012, p.433). Arnott (2013) suggested that educational research should be placed on how children engage with these games and digital technologies as well as their positive impact on children's interactions and engagement. Thus, there is a need to look at the unique feature of games to gain a better understanding of how they can be informative instead of how we can use them in education. Overall, this chapter presented a background of the potential use of digital games in the classroom, an examination of digital games and learning in terms of philosophy and psychology, and review of some previous research across culture and abilities. This has been important to set the scene for the following chapter which is about MC, and which is the scope of this thesis.

CHAPTER 4: SYSTEMATIC REVIEW: MINECRAFT- SELECTED AS AN ONLINE COMPUTER GAME

4.1 Introduction

This chapter provides a background to Minecraft (MC), by way of a systematic literature review. The review is explored using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The PRISMA framework is an evidence-based checklist for conducting and reporting in systematic reviews and evaluating randomised trials, but it has also been used as a review resource in other types of research (Moher et al., 2009). In the next section, MC is introduced, together with its elements, in order to provide an overview of the game and its function.

MC is a sandbox game, created and developed in May 2010 by Markus Persson, better known as Notch, with a single or multi-player mode option. MC is set in a three-dimensional environment, allowing players to break and place blocks and can be run on a phone, computer and any tablet device. Although there is an enormous number of sandbox games, such as Starboun, Warband and Dwarf Fortress, MC is unique because it is unlimited, with endless activity usage, and a huge spread. MC offers a different type of gaming, designed as a creative game allowing players to set and achieve their own goals (Brand & Kinash, 2013). The game is affordable and in high demand. At the beginning of 2014, Notch announced that the number of people registered as MC users had reached 100 million (Markus, 2014). Yee (2015) surveyed over 100,000 players and reported that 79% of players are male and 19% are female. MC offers three main levels of playing mode: Creative, Survival and Hardcore. There is also the ability to access global multiplayer modes, such as Adventure or Spectator. The difficulty level can be chosen from four options: peaceful, easy, normal and hard. These levels allow players to choose the one most suitable for them to be able to perform well, with the benefit of lesson objectives and increasing skill ability.

MC is considered to be popular as every player is equal regardless of gender, race, background or capabilities. In addition, Gauquier and Schneider (2013) demonstrated

that this game was unique because the critical thinking element was huge, with players affected by their choices, resulting in the quality of life within the game to be impacted. It is a game that focuses on creativity, with players using a variety of cubes in different colours to build a three-dimensional world. There are unlimited activities and players can create and work together to establish an imaginary world, with activities such as hunting, building and exploring, which is easy and without restrictions or boundaries (Elliott, 2014).

4.2 Minecraft for Educational Purposes

Playing computer games, whether on computers or hand-held devices, has increased massively within the last decade (Wernholm & Vigmo, 2015). Since late-2011, MC has had a specially designed educational version, called MinecraftEdu (MCEdu), with many modes encompassing curriculums and exercises for various standards. Many studies have suggested that the game can be used for educational purposes and implementing the game-based learning concept encourages student engagement (Sáez-López et al., 2015). Researchers suggested this is an advantageous educational game as it supports and encourages cooperative learning, whereas other games tend to focus on competitive learning (Al-Washmi et al., 2014; Butler, 2017; Quiring, 2015).

MC was not specifically designed for educational purposes (Willett, 2015), but given its creative use, it can be used as an interactive teaching tool. However, there is limited information about the relationship between the use of MC and education (Hanghoj et al., 2014; Marlatt, 2018a; Sáez-López et al., 2015). Using new media to form an engaging curriculum and provide students with the chance to direct their own independent learning and achieve their own goals (Elliott, 2014), will improve their skills and personality. MC seems to be advantageous as it merges the conceptual idea of collaborative learning with a serious game (Wendel et al., 2013) and supports and encourages cooperative learning, rather than competitive learning (Al-Washmi et al., 2014). This is important especially for children with ASD where Bossavit and Parsons (2018) find that higher frequencies of social behaviours were observed in the cooperative game compared to the competitive one.

In the following section, I will review and discuss the use of MC in previous research literature, particularly contemporary educational research, and how the use of MC has contributed to developing social skills, along with its effect in the classroom or educational setting for all students, regardless of their abilities. From an educational perspective, both advantages and disadvantages will be considered, together with identifying any gaps. The EBSCOHost research websites identified many MC articles from magazines and newspapers, but not a single systematic literature review that explains and summarises previous research for parents and teachers to ascertain whether MC is a useful educational tool to teach social and academic skills. Therefore, this chapter reviews the use of MC to provide an imperative insight for parents, students, teachers and researchers on the knowledge base of MC and the benefits of this game in the classroom.

4.3 Methodology

Minecraft is typically played by children and young people. Researchers, educators, and parents have debated what makes it so appealing and whether there is any intellectual or social value in such gameplay. There have been previous systematic reviews on computer games and serious games (Connolly et al., 2012; Grossard et al., 2017), Game-Based Learning (Abdul Jabbar & Felicia, 2015), and digital or computer games (Boyle et al., 2012; Clark et al., 2015; Tobias & Fletcher 2012; Mekler et al., 2014), but they did not focus on Minecraft/Autcraft. Hence, the review question of this paper is whether Minecraft/Autcraft has any impact on children's social and academic learning. Therefore, this article aims to review the contemporary research on the use of Minecraft in an educational setting in order to summarize and synthesise current literature with its available evidence to find whether Minecraft/Autcraft can be utilised in the classroom. Reviewing the use of Minecraft/Autcraft in an educational setting is significant in demonstrating its advantages and disadvantages for further classroom implementation and learning interventions. This review will develop researchers' current understanding of using the game as an educational tool or instructional psychology and summarize the

reported benefits and limitations. A search of the EBSCOHost research website produced large results from newspapers and magazine articles, without a single systematic review of Minecraft/Autcraft, and there is currently no literature review that examines whether Minecraft/Autcraft is a useful teaching tool or what practical limitations might be avoided in future classroom execution. Thus, this review examined all available research on Minecraft/Autcraft used as a method of teaching or developing students' skills in the classroom, and its benefits or drawbacks.

The review was conducted on a broad literature search designed to identify all available peer-reviewed journal articles reporting on empirical studies on the use of Minecraft/Autcraft up to the 31st March 2019. All articles that encompassed primary data sources for the use of Minecraft/Autcraft have been utilized, including psychological and sociological studies. This specific focus on peer-reviewed literature would afford the most reliable data on the effects of Minecraft in teaching and learning, with the acknowledgement of possible publication bias. However, since both the negative and positive effects of Minecraft are equally important and publishable, selection bias in one direction or another is unlikely. Thus, this review provides the best possible presentation of both positive and negative effects of Minecraft in educational contexts.

The review went through five stages: identifying the research problems, screening relevant work, discussing inclusion criteria and negotiating eligibility, summarizing evidence from included studies and interpreting the findings. The eligibility process was conducted by an independent rater and then compared, disagreements discussed, and an agreement achieved for each paper based on meeting the inclusion criteria (stated below). The methodology of the review used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher, Tetzlaff & Altman, 2009). PRISMA is an evidence-based set of checklists and procedures for conducting and reporting in systematic reviews and meta-analyses. The PRISMA framework was used initially for reporting reviews and evaluating randomised trials but has also been used for reporting systematic reviews of other types of research.

In this review, we used the PRISMA checklist and PRISMA 2009 Flow Diagram to help develop appropriate review processes.

For this review, a literature search was conducted on 17th April 2019 using the EBSCOHost research website, which carries a wide range of academic research databases. The research terms were only "*Minecraft*" or "*Autcraft*". A significant number of academic resources and journal articles were yielded. In relation to identifying related databases, 11 academic and psychological ones were selected as follows: *British Education Index, Child Development & Adolescent Studies, Education Abstracts (H.W. Wilson), ERIC, Library, Information Science & Technology Abstracts, PsycARTICLES, PsycBOOKS, PsycINFO, Communication & Mass Media Complete, OmniFile Full Text Select (H.W. Wilson), and the Teacher Reference Center*.

We found 452 results, limited to 248 after removing exact duplicates between databases. This was restricted this to 82 papers that were peer-reviewed for journals. This was further reduced to 79 papers written in English. After that, an examination and selection process was carried out following the PRISMA framework (Figure 4.1), which demonstrates the screening process. Table 1 in appendix 1 explains exclusion reasons. Papers were included if they met all the following criteria:

- The study had to have been published in scholarly (peer-reviewed) journals to meet a minimum standard of quality and reliability from other scholars' point of view (book reviews, conference abstracts, proceedings papers, newspaper articles, magazine articles, and media reports were excluded).
- It had to focus on the educational, psychological or sociological use of Minecraft/Autcraft.
- It had to be an empirical examination of the use of Minecraft/Autcraft. Thus, all secondary sources were excluded.
- It needed to be in English.

The following PRISMA (2009) Flow Diagram explains how the criteria worked through the databases' websites.

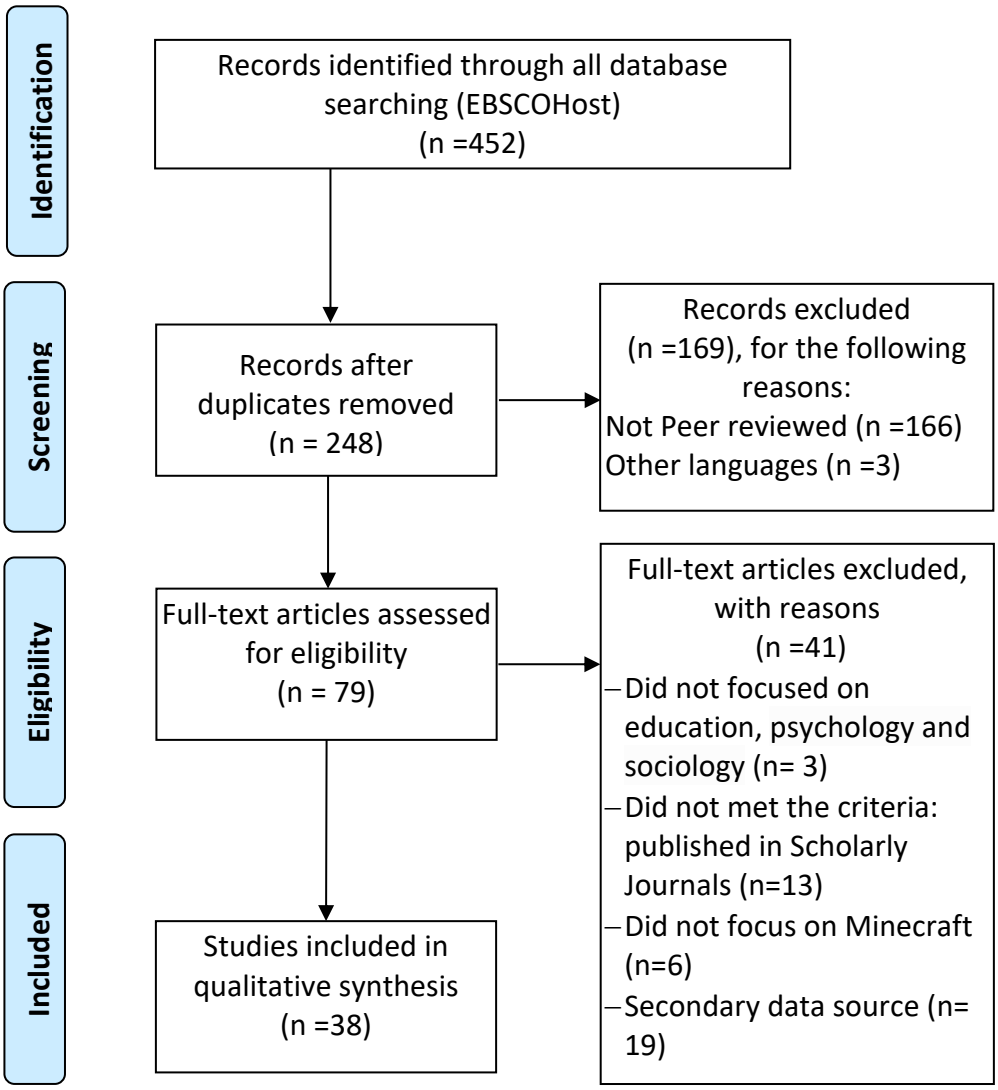


Figure 4.1: PRISMA (2009) Flow Diagram showing the process of article selection

The eligible papers (n=38) were coded and analysed using a data extraction table that included the research aspects and outcomes (Table 4.1 and Table 4.2). The characteristics correlated to the included papers were coded so as to collate the (a) research aim or purpose, (b) research design (e.g., the intervention, research setting, etc.), (c) research sample (size of the sample and age), (d) data collection approach (e.g., survey, interviews, experiment, etc.), and (e) key findings. After that, the quality of the included paper was assessed and scored according to the Connolly, Boyle, MacArthur, Hainey and Boyle (2012) scale (Figure 4.2). The Connolly et al. (2012) scale focuses on the following five criteria: the type of research, the study's

appropriateness of the method and analysis, generalisability (size and representativeness of the sample), the study's importance to this review, and confidence in the presented results. Each one of these criteria received a rating (3 = high; 2 = medium; 1 = low) and a total score (maximum = 15). The key findings section (§ 4.4) presented in the results section of this review was conducted using thematic analysis and synthesis of qualitative research in systematic reviews. The thematic analysis was divided into six phases according to Marshall and Rossman (1999): organising the data, generating themes, coding the data, testing understanding of the data, searching for alternative explanations of the data, and writing up the data analysis.

In summary, our research terms were simply “Minecraft” and “Autcraft”, and we included all peer-reviewed articles that were written in English and included first-hand evidence (primary data sources), regardless of the results. Therefore, this review provides parents, teachers, school leaders and academics with the best possible and most reliable survey of both the positive and negative effects of using Minecraft for teaching and learning.

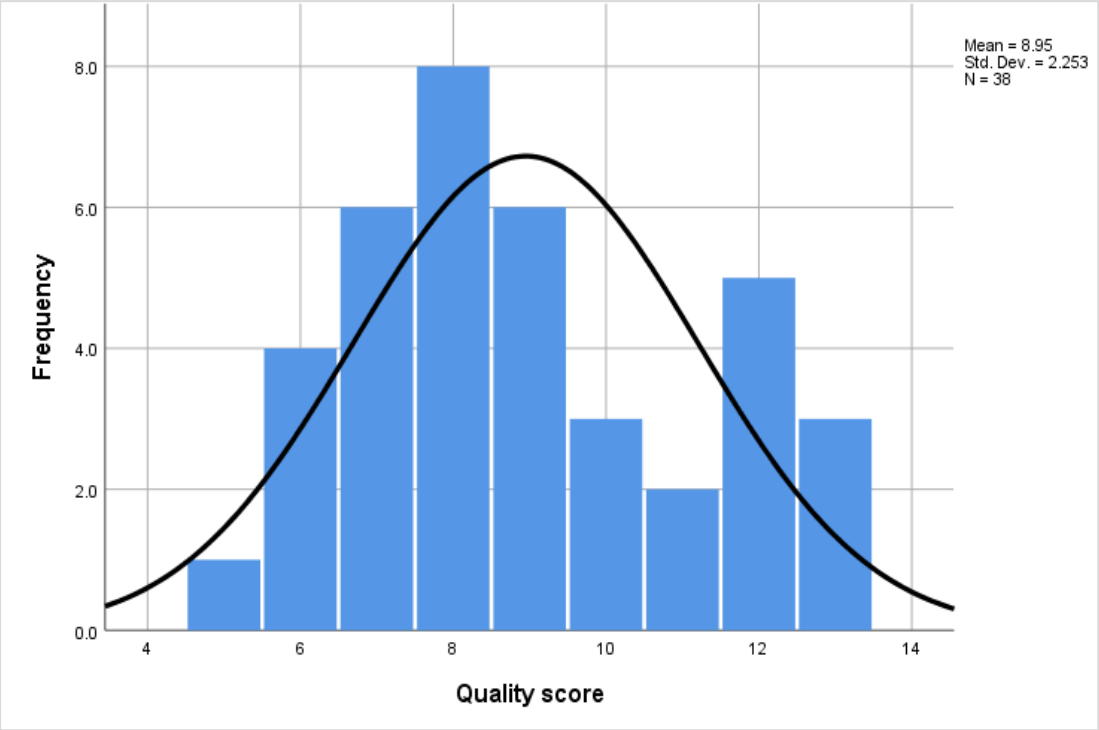


Figure 4.2: Histogram of the weight of evidence quality score for included papers

4.4 Results

Studies included in this review showed a variety of employed methods. Seven studies (18%) used quantitative approaches, 21 studies (55%) used qualitative methods, and 10 (26%) used a mixed-methods approach. Although 23 studies (61%) included an educational, psychological or sociological intervention in the investigations, only 6 (16%) included a control group. The age of the samples was also different: eight studies (21%) included children aged 10 or less, 14 (37%) included teenagers aged 11–17, 11 studies (29%) included adults aged 18 and over, and five studies (13%) were indefinable due to the clarity of the presentation of research design. In terms of sample size, almost half of the studies used 1–16 participants (21 studies; 55%), whereas five (13%) and seven (18%) studies had a sample size of 17–64 and 65–205 participants, respectively. Two studies (5%) had a sample size of 322 and 394 participants, and another three studies (8%) did not use a sample.

As shown in Figure 4.2, each of the included papers was given a quality score, the mean rating for the 38 paper was 8.95, and a cut-off score of 9 was used, based on the mean rating scores. Since the number of included papers was small, all papers were discussed regardless of the quality score, but the emphasis was placed on papers rated 9 or above as they were considered to provide stronger evidence of the use of Minecraft/Autcraft in academic and social learning. Furthermore, Figure 4.3 shows the increasing number of publications over the years, showing the importance of this topic in social and academic learning. Figure 4.4 explains the methodological choices for the included studies, as previously explained.

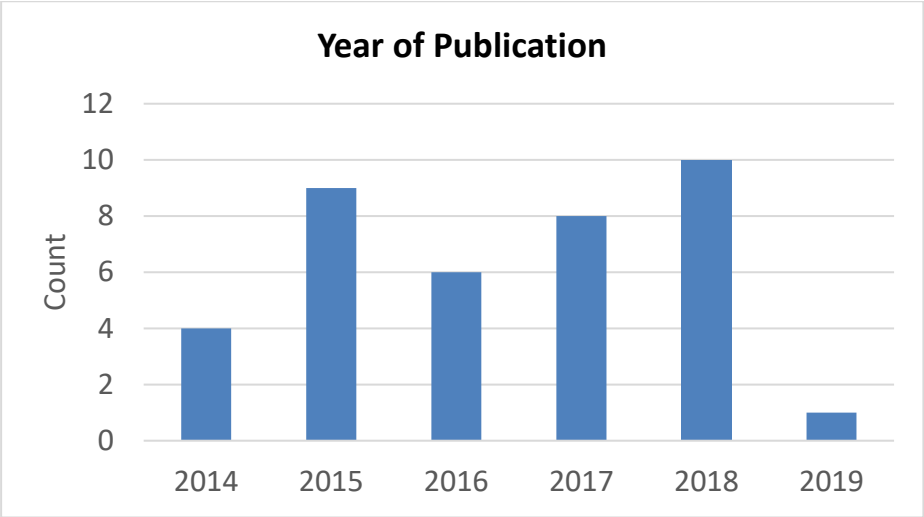


Figure 4.3: Number of publications on Minecraft according to the year of publication

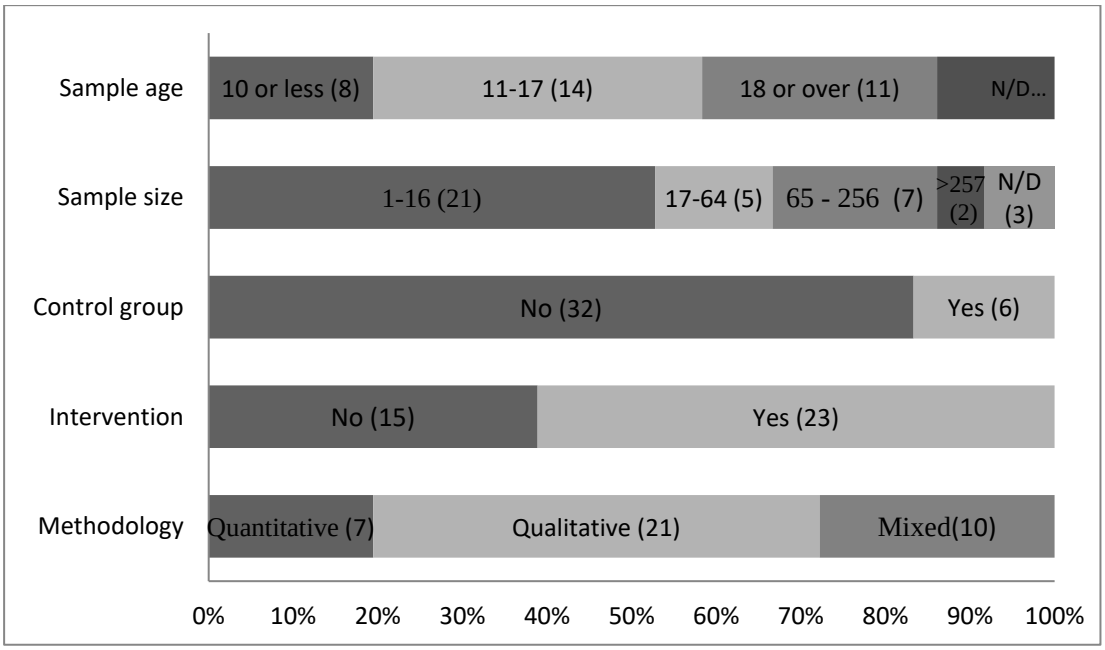


Figure 4.4: Methodological choices for reviewed studies

Most of the included articles illustrate how Minecraft can be a useful tool for educational use (Table 4.1), and social and communication learning (Table 4.2). Given that there are only a small number of eligible papers, all 38 are summarized and discussed. In the following sections, the articles are reviewed on the basis of the skills that are impacted by the research.

Table 4.1: Summary of all included studies about Minecraft focused on academic and motivation to learning outcomes

Author/ citation	Study aim	Research design (intervention)	Sample N (Age)	Data collection approach	Key findings	Connolly et al. scale score
Baek and Touati (2017)	Testing relationships between enjoyment & learning styles, collaboration skills, intrinsic motivation, game attitude, & achievement.	Participants were given two tasks for their gameplay: 1) choosing and replicating a maze in MC from three levels of difficulty; 2) building the main school building and playground in MC.	164 (11-12)	Students were given: the Computer Game Attitude Scale, Enjoyment Test, Learning Style Inventory, Computer Game Attitude Scale, Collaboration Attitude Test, & Intrinsic Motivation Inventory.	• Players with more motivation experienced higher levels of enjoyment. MC as an educational tool can motivate students intrinsically, regardless of extrinsic roles in driving students' behaviours. • Players need a more positive attitude toward a game to be intrinsically motivated to play. • Students exhibiting more positive collaboration skills were more able to perform in gaming achievements.	11
Butler (2017)	Examining the semantic properties of spontaneous naming systems and potential influence.	Participants explored a closed environment in MC to locate an assigned goal, verbalizing their ongoing thoughts.	12 (16-26)	Data were collected through observing participants for considered proper nouns while the task was carried out for the twelve runs.	• Names do serve a functional role in providing cognitive navigational assistance. Functional identificatory semantics was consistent, although the nature of the participatory group was limited. There was a significantly strong negative correlation (−0.88) between numbers of names generated and speed of task completion, so cognitive mapping is highly impacted by the name development.	7
Checa-Romero and Pascual Gómez (2018)	Examining empirical evidence of creativity development using MC in the classroom	Students were enrolled in an eight-week MC workshop and asked to build 'the house of their dreams'	85 (11-12)	Pre-test/post-test through the CREA Creative Intelligence Test	• MC and the audio-visual productions allowed students to creatively express their conceptions of the house of their dreams. • Using games in the classroom is a challenge for educational institutions, teachers and students. • Results show a significant increase in creativity highlighting the need to be used in classrooms to develop	12

					innovative educational contexts. Using MC, with its high level of freedom, in an educational subject led to an increase in students' creativity.	
Cipollone et al. (2014)	Discussing the use of MC as an educational tool in a formal educational setting in an English class.	Participants were divided into 5 groups. MC and the assignments were introduced in two options - using MC to create their video or using a camera to video their story.	20 (13-16)	Researchers observed the participants' film and provided a shared server. Teachers were interviewed during and after the project.	• Students were able to create narratives using MC, developing multiple personalities with a range of character traits. • MC gave students access to a creative space with less cost. • Researchers observed meaningful, useful interaction between students and the content through MC. • Limitations of the study: The teacher was not a technology supporter and thought negatively about the use of MC; some students were unsuccessful in the project due to unfamiliarity with the game.	9
Craft (2016)	Reporting the use of MC to supplement history and foreign language classes.	Server with a simple Roman temple was created to reproduce the temple.	49 (13-18)	The researcher observed and checked progress, lent assistance and compared pre- and post-assessments.	• The project was overall successful; some evidence being in the pre- and a post-written assessment on student understanding of Roman architecture. Performance increased from 13% (answers correct) in the pre-test to 60% in the post-test. • Some students completed the tasks before the deadline. Some reported it was overwhelming for them to find information about their temple or were distracted, but after including a step by step instruction, confidence in the use of MC increased.	8
Elliott (2014)*	Finding ways to develop curriculum in English and Humanities class using	Purpose of using MC was to explore ways to develop curriculum and engage students who have major	N/D (Avg. 14)	The researcher interviewed students, teachers; used formative surveys; collected Snapshots, text record, video game	• Some students engaged deeply with the games and reported highly desirable schoolwork. • The study focused on a case study of a teenager who had poor school attendance and difficulties with learning space. After introducing MC, the student became more confident to share his expertise of MC; his social	9

	"non-linear new media text".	reading, writing and behavioural issues.		levels, pictures and classroom audio.	interaction increased; his attitude toward school become more positive; he began to engage in traditional activities and was more interested in talking to teachers. • Limitations of the study: limited to one case study, and the number, age and gender of students were missing.	
Hill (2015)*	Describing a library project exploring innovative options for embedding information literacy skills by utilizing MC.	The MC club met in the school library. Students chose to lead a role in building a virtual world library, with all its facilities with digital citizenship.	8 (10-11)	Observations of children's activity in the virtual library from October 2013 through April 2014; interviews about their experience during the last month of the project; and mixed reality videos, both in the physical school library and in the virtual world.	• Students were enabled to adopt their own skills expertise, e.g., one student showing strong leading skills took the role of the game designer; another became computer technician …etc. • The researcher reported a strong observation of engagement in programming and developing MC. Collaboration, critical thinking and constructing the virtual works were observed, embedded in digital citizenship. Students reported positive learning. • Limitations: after a month the librarian's laptop crashed, and the whole project was lost.	8
Marcon and Faulkner (2016)	Examining the use of MC as an academic tool to motivate girls' literacy practices in the English classroom.	The study lasted two weeks of 9 meetings. The unit of MC was added to bridge the gap between formal and informal learning.	14 (12–13)	Data collected through observations, interviewing two girls, a survey and screenshots; and students' MC posts/comments on Instagram and Facebooks.	• Girls reported that MC was an attractive text for literacy learning and helped them collaboratively and strategically in designing and immersing themselves in the game world purposefully, as well as allowing them to use problem-solving skills and negotiations for distributed learning initiatives. • Girls used expressive language to pursue assistance from other players and provide the meaning of their actions and expressed their interest and gaming activities within their online social tools, indicating more engaging in learning beyond the classroom.	9

Marlatt (2018a)	Exploring the use of digital literacies to support student-centred literary analysis	Students read a novel together, then conducted a literary analysis with MC in three 90-minute gaming sessions.	1 (18)	Observation of how one student, Stella, engaged with the novel and the literary analysis in MC; with her being interviewed 3 times to understand the concepts behind what she produced via MC and how those activities are related to the text.	• Stella crafted scenes well that linked to the reading of the text, showing detailed and sustained engagement well with literature. • She demonstrated an understanding of literacy potential for impacting families and society, showing critical awareness of social inequality and prejudice in sociocultural interaction. • Players showed strategy and problem solving, and her analysis offers her new lenses to examine her identity.	6
Marlatt (2018b)	To describe students' engagement in the literary analysis of a novel using MC.	The novel was read with the students, and they were asked to re-create two scenes of their choice from each chapter using MC instead of daily comprehension quizzes or vocabulary worksheets.	1 (20)	Data collected through observations of a player's moves on the screens and observing their social and textual interaction. The observed player is from a minority and had experienced failure in literacy.	• Through MC, players were excited about literature. • Yem (the observed player) was creative and enjoyed gaming and reported that it is the first time he was given a choice on what and how to read in high school. MC motivated him to engage with the text and was a vehicle for his during-reading visualization. • MC offered the students with the opportunities to cultivate multicultural perspectives. • Offering interesting readings and numerous entry points into those readings for students is important for social justice which highlighted students' diverse literacy practices.	6
McColgan, Colesante, and Andrade (2018)	To find if a game-based experience had an impact on pre-service teachers' skills,	Students were enrolled in issues in Contemporary Education class that included using MC to create lessons	55 (18-23)	Pre-post test Likert-scale survey designed by the instructor and aligned with the objectives of the course to evaluate the	• Most groups decided to create lessons in STEM topics regardless of their own major. Mean scores were higher in the post-test than the pre-test for perceptions of skill using technology and confidence with new technologies, with no gender differences.	11

	beliefs, and confidence using games for teaching.	for middle and high school students.		effectiveness of the project, and "included questions about students' attitudes, time using social media, time spent on games and gaming with technology, and skill with technology"; and reflection essays.	• Three themes of positive changes in the classroom and their beliefs about using MC emerged, which are the acquisition of knowledge/ skills, engagement, and collaborative interaction. • They mentioned five barriers, including the steep learning curve, time, and complexity for teachers, student distractibility, and complexity for students to learn the game. Pre-service teachers were sceptical of using games for teaching in the classroom.	
Moffat et al. (2017)	Testing three games' impact on creativity.	Participants asked to play one of three games for 30 minutes: puzzle, sandbox or a first-person shooter.	21 (18-30)	Participants completed a survey afterwards. Creativity was measured by the Torrance Tests of Creative Thinking (TTCT).	• Sandbox game affected creativity the least of the three types of games. Flexibility, as a form of creativity, was affected much more than fluency and originality, which had not been impacted much in this experiment - players had little or unobservable change in the fluency or originality in their ideas. • Video games engage students creatively; this temporary effect on creativity differed, based on the game type.	10
Nebel, Schneider, Schledjewsk, et al. (2017)	Presenting a comparison of different goal types within an educational video game, using MC as a content creation tool.	Three groups of students (specific performance goal, specific learning goal, goal-free condition) did five tasks to learn about the basic elements of computer science and electrical engineering.	87 (17-31)	Some observations and surveys were used to measure outcomes. The survey was on Current Motivation; Cognitive Load Measurement; Survey for retention, transfer and far transfer; and participants rated the fun they had.	• Having specific learning goals lowered extraneous and intrinsic cognitive load; players reported more fun and effective impacts of goal-setting and deeper motivational processes. • In the goal groups, participants showed anger, impatience or confusion after not being able to reach their goal. Participants in the goal-free condition started by reading the task information and then tried to solve the tasks, whereas the specific performance group read a minimum of texts to understand the requirements to solve the tasks. However, no significant change in learning performance was found.	13

Petry (2018)*	Examining children's conception of the relationship between work/labour and leisure in game playing.	No intervention reported. The researcher observed some playing sessions.	5 (6-12)	Semi-structured interviews and five play sessions recorded of children who identified themselves to be MC fans.	• YouTube and books stated as the main resources for learning about how to play and be creative. Children indicated some aspect of learning from the game. MC helped them to collaborate with others, engage, discuss, and share knowledge. • However, most children had never heard the word 'labour' in playing; instead, they use 'work'. • The play involved much work, requiring a particular state of mind and fun; when players lose the fun, they lose the game.	7
Quiring (2015)	Bridging gaps between the literature and research on virtual worlds.	No intervention was reported.	1 (N/D)	MC analysed through the researcher's own experience and analysis of gameplay videos uploaded to YouTube.	• MC discussion was based on the themes of Alteration/Change - players' ability to alter their virtual environment; Proximity - MC space to participate in shared projects and events; Conflict/Cooperation - the multiplayer servers where players centre on specific projects and negotiate conflicts. MC is no less real or meaningful than human interaction outside the game.	5
Sáez-López et al. (2015)	Evaluating the use and outcomes of MCEdu and discussing attitudes of the educational community.	MCEdu was used, where teachers developed a unit to evaluate the outcome of using this game for the experimental group.	Stage A) 181 (11-14) Stage B) 205 (N/D) Stage C) 131 (11-14)	A) Learning, of 131 students in the experimental group (MC group), and 50 in the control group assessed through formal tests. B) Surveys to analyse the attitude of parents, teachers and students regarding the use of MCEdu.	• Test results of the academic unit did not show a significant difference between the experimental and the control groups. • 98.5 % of participants thought MCEdu was fun; enables discovery (96.6%), encourages learning (97.1%), enables rich interactions (96.6%), and enhances creativity (96.1%) and learning (83.4%). • Students interacted with each other in English, although there were some from Spain and the USA. • Limitations of the game: 24 people thought the school lost time applying it and 36 people thought it should be used outside the classroom. Parents were the most negative	13

				C) Qualitative analysis of an online discussion platform.	regarding these two points, with 79.1% and 75% of the frequencies, respectively.	
Saito et al. (2017)	Examining whether a visual-based input method induces a different attitude or outcomes of programming.	Participants attended a lecture, which taught the basic concepts of programming environments.	72 (6-15)	Pre- and post-questionnaires given to participants before and after the lecture, assessing: Interest, Difficulty, Usefulness, Fun, and Willingness, with five Likert scales.	• Participants' attitudes for interest, difficulty, and fun towards programming improved and became positive. The results included that the Visual Group had a larger positive change in the attitude toward programming than the Text Group. • The visual input increases positive attitudes towards programming more than the text input method and seems to be good for an introduction to programming and in a programming implementation environment for first learners. • Limitations of the study: groups were unbalanced.	10
Smolčec and Smolčec (2014)	Reporting on how MC has helped their son with developing language skills.	No intervention was reported.	1 (10)	Observation of their son's monitoring of his work online playing MC and the impact on his linguistics skills of listening, speaking and writing.	• MC helped the child to learn collaboration and build friendships. They learned vocabulary, which helped them to be more confident as a speaker and as a writer. Different English skills were learnt by watching YouTube videos. • Limitations of the game/study: the child learnt inappropriate language through interacting with others, such as swearing, and developed an addiction, spending too much time playing rather than doing other activities.	7
Swier (2014)	Considering goal-orientated communicative tasks for virtual worlds, adopting MC as	Three goal-orientated tasks that involve some exploration and modification of the environment were	6 (19-29)	Pre- and post- Likert questionnaires using a five-point scale to explore the attitudes of the participants towards completing goal-orientated tasks in	• MC is a useful platform for developing communication skills for language learners; negotiation was clearly observable; linguistic interaction between players decreased during periods where players were not faced with an immediate goal, such as solving a problem or making a decision. Participants completed the tasks in the	9

	a platform of choice.	designed by the participants.		MC; and a semi-interview about completing the task.	same amount of time; stating that their communicative interaction improved their English. • Limitations of the study: the sample is small.	
Wernholm and Vigmo (2015)*	An attempt to find how online technologies could influence data collection opportunities and process.	Children played as one community on the same server. Their playing was recorded using FRAPS software.	3 (> 15)	FRAPS - an online tool, allowing players to video record their play, was used and then the dialogues were transcribed and analysed in regard to which of all these dialogues can be characterized as knowledge-making dialogues.	• FRAPS helps researchers get closer to children, and not distribute children's participation. Participants' interactions were in the Swedish language and English concepts. Analysis of the video recordings showed players gained and shared knowledge and became better through collaboration with the language use. • Limitations of the study - children expressed annoyance when having technical problems.	8

* *Social and communication learning is a secondary outcome for these studies*.

4.4.1 MC can Increase Motivation for Learning

Minecraft is thought to be a useful tool for increasing students' motivation and interest in their learning environment. In fact, players with a basic intrinsic motivation experienced higher levels of enjoyment in the game (Baek & Touati, 2017); and for academic learning, games need to be enjoyable to be effective. Although the ability to enjoy was not defined in the reviewed studies, there is a tendency to be defined by having a positive attitude about the Minecraft experiment and the learned content. Nebel et al. (2017a) reported that student's reactions to the Minecraft experiment were pleasant and researchers received only positive feedback from students about the experiment because using Minecraft allowed the transfer of educational principles to a new pedagogical medium, with the game offering players more opportunities for creativity. A positive attitude is essential for learning; the goal was not only learning to read but to engage students and create a positive, inspired environment (Nebel et al., 2017a).

Although having specific learning goals lowered extraneous and intrinsic cognitive load, players reported more fun and effective impacts of goal-setting and deeper motivational processes (Nebel, Schneider, Schledjewski & Rey, 2017b). However, many participants working within a group with defined goals exhibited anger, impatience or confusion when it was clear they would not be able to reach their goal, which may be deemed a disappointing element of the game. In contrast, participants active in the goal-free environment started the game by reading the information and trying to solve the tasks (Nebel et al., 2017b). This is clearly a limitation to the implementation and preparation for the Minecraft study and not a limitation of Minecraft; having a specific learning goal with a defined task would contribute to the children's learning and reduce wasted classroom time.

Minecraft can also be considered a useful method for promoting student engagement in school and the community. Many researchers identified clear engagement advantages for students as a benefit of using Minecraft. For example, Cilauro's study (2015) reported that using Minecraft allowed disadvantaged young

people to be socially included and involved in the online game, as well as to participate socially with others from different cultural backgrounds (Cilauro, 2015). Hollett and Ehret (2017) concluded that Minecraft helped teenagers to engage outside the school context through a shared interest in the game. Another example was reported by Elliott (2014) who stated that prior to the Minecraft experiment, one student had poor school attendance and struggled within a formal learning space and tended to refuse to accomplish assignments and disengaged from his schoolwork. However, after the Minecraft intervention, the student displayed remarkable changes, with the teacher reporting that he had not only become more confident with his peer, but that Minecraft had rekindled his interest in school and he had begun to attend class regularly, with a more positive attitude (Elliott, 2014). Stone, Mills and Saggers (2019) investigated whether MC can be used for social interaction for three children with ASD, and reported that playing MC with others provides opportunities for social and communicate interactions in multimodal ways that are not available in face to face and offline contexts, which encourages children with ASD to initiate and sustain social interactions in inclusive educational settings.

Furthermore, Ellison (2017) reported that a participant from a minority group chose to create a digital story using Minecraft, illustrating the intended literacies and racial identities, inherent in digital participatory choice cultures. The decision to use Minecraft meant he was able to plan and map the story from beginning to end, creatively and independently, and felt comfortable operating within Minecraft. He reported that 'he was afforded opportunities to make decisions and became a problem solver and critical thinker while creating and exploring Minecraft worlds' (p.31). The study enabled researchers to understand how the race was essential to the participant, clearly evidenced in his digital story, where he was able to build on his knowledge and identity.

Although Minecraft could be considered as a great engaging tool because even those with no experience of the game can engage with it easily, Marcon and Faulkner (2016) stated that older participants and those with no experience of the game had some difficulties. Cilauro (2015) reported similar issues when a number of young

people were either not able to fully participate in the activity or were not able to be part of the group dialogue, which led to some isolation. Potentially, this is a disadvantage because all educational tools should engage all students in the activity. On the other hand, children in Petry's (2018) study emphasised that the freedom of being able to create whatever they wanted—the 'open space' idea—was the main reason to continue playing Minecraft. Likewise, Checa-Romero and Pascual Gómez (2018) concluded that using MC, with its high level of freedom, in an educational subject led to an increase in students' creativity and engagement with the classmates.

4.4.2 Academic Learning with Minecraft

Minecraft is a tool that can be used for educational purposes. McColgan, Colesante and Andrade (2018) examined pre-service teachers skills, beliefs and confidence in using games for teaching, and reported that most of the participants decided to create lessons in STEM topics regardless of their own major. The experiment results show that the mean scores were higher in the post-test than the pre-test for perceptions of skill using technology and confidence with new technologies, with no gender differences. Participants reported three themes of positive changes in the classroom and their beliefs of using MC emerged, which are the acquisition of knowledge/skills, engagement, and collaborative interaction. Therefore, teachers and parents have begun to adopt it as a tool to enhance and develop children's academic skills and facilitate learning. For example, Saito, Washizaki and Fukazawa (2017) reported that participants' attitudes toward programming improved and their interest in programming increased (Saito et al., 2017). In addition, students in Callaghan's study (2016) reported that they felt that MinecraftEdu helped them attain their learning goals and played an important role in creating a specific task and accomplishing the desired outcomes; in fact, all students demonstrated a higher level of 'creative' and 'evaluative' skills (Bloom's Taxonomy; Ormell, 1974). Being creative in learning is an important aspect of today's pedagogy. Checa-Romero and Pascual

Gómez (2018) examined empirical evidence of creativity development using MC in the classroom and reported that a significant increase in creativity was found, highlighting the needs to be used in classrooms to develop innovative educational contexts. Another study conducted by Moffat, Crombie and Shabalina (2017) reported that sandbox games affected creativity less than other types of games, such as a puzzle or first-person shooter game. Flexibility, as a form of creativity, was affected much more compared to fluency and originality where players exhibited little or no observable changes in their ideas; and, whilst bearing in mind the limitation of this study's results, computer games could be used to engage students in a more creative state of mind, necessary for their learning (Moffat et al., 2017). Moffat et al. concluded that computer games seem to have a temporary effect on creativity, but this effect differs based on the game type.

Minecraft can be used to encourage students to become skilled in creating narrative scenarios by using language proficiency to optimise scenarios. Cipollone et al. (2014) reported that three groups out of five were able to create narratives using Minecraft and developed multiple characters with a range of personality traits, and Minecraft gave students access to a creative space, with less cost, to explore different narratives with a meaningful and useful interaction between students and the content. Marlatt (2018b), moreover, examined students' engagement in literary analysis of a novel and reported that Minecraft motivated the participant to engage with the text and was a vehicle for their during-reading visualization and offered students with opportunities to cultivate multicultural perspectives. Marlatt (2018a) also reported that MC help learners to craft scenes well, that linked to the reading of the text, showing detailed and sustained engagement with the literature.

Furthermore, teaching first or second languages can be aided by using Minecraft as a mediator between players and the academic content, as it increases the learner's desire to engage. Marcon and Faulkner (2016) reported that Minecraft was an attractive text for literacy learning and helped participants to work collaboratively and strategically in designing and immersing themselves in the game world, as well as allowing them to use problem-solving skills for distributed learning initiatives.

However, playing Minecraft in the classroom was not confined to participants who had played before or had experience of the game, as reported previously, but offered players an opportunity for learning, allowing players to engage with others around them, and participants used expressive language to obtain assistance from other players and provided meaning for their actions, which resulted in an engaging, collaborative environment. They expressed their interest in gaming activities in their online social media platforms, indicating further learning beyond the classroom. In fact, there was robust evidence that the games provided social and cognitive opportunities for creating and strategizing while playing. They exhibited problem-solving skills and positive achievements during gameplay (Marcon & Faulkner, 2016).

Moreover, Minecraft was utilised as a tool to practise and engage with second language skills. Smolčec and Smolčec (2014) reported that Minecraft helped their son to learn and develop his English and speaking skills, because he communicated with native speakers through Minecraft and improved his listening skills by watching and listening to Minecraft videos on YouTube, which resulted in him to be able to be 'skilfully creative and speak English with an American accent' (p.13). Another study was undertaken to consider goal-orientated communicative tasks for virtual worlds adopting Minecraft (Swier, 2014). Researchers reported that Minecraft seemed to be a useful platform for developing tasks for language learners, and negotiation was clearly observable in the completion of the three tasks, meeting the intended goals. All participants indicated that they enjoyed the session and were able to manage the completion of assigned tasks in roughly the same amount of time. Participants reported that their communicative interaction during the tasks could improve their English, with the opportunity to speak English and work together (Swier, 2014). Hence, Minecraft was able to improve their language skills through social interaction with other players. Sáez-López et al. (2015) found similar second language improvements in their study. Participants were asked to engage in Edmodo, a platform discussion where players, teachers and parents interact and communicate with each other between the US and Spain. Researchers found that foreign students interacted with each other in English, although they were Spanish, which reflected

the advantages of using Minecraft as a tool for practising communication and second language skills. Thus, despite Minecraft not being explicitly designed to improve language skills, it can assist players in practising in this field.

Minecraft might also be used for teaching history and architecture. Sáez-López et al. (2015) stated that the results illustrated that 97.1% of participants in the experimental group (who studied a historical event via an immersive environment in MinecraftEdu) believed that the game encouraged them to learn about historical content, although the results of the academic unit testing did not show a significant difference between the control group and the experimental group. Furthermore, Craft (2016) reported that although some students were able to complete the task (given within the Minecraft world) before the deadline, many did not; nonetheless, the outcome of this project was largely successful, with evidence of success presented in the pre- and post-written assessments on student understanding of Roman architecture. The growth of students' scores from pre- to post-assessment ranged from 20% to 38%; the average growth in score was 29% (Craft 2016, p.360). Therefore, Minecraft can facilitate some students' learning of historical topics.

Table 4.2: Summary of all included studies about Minecraft focused on social and communication learning outcomes

Author/ citation	Study aim	Research design (intervention)	Sample N (Age)	Data collection approach	Key findings	Connolly et al. scale score
Bebbington and Vellino (2015)	Defining how information literacy is used through MC and how these skills were demonstrated in informal online spaces.	No intervention - researchers analysed online discussion threads, August 2011 - June 2013, located from MCforum.net, and interviewed MC players.	8 (15-16)	Stage A) analysed online interaction of 20 threads with 510 participants in a public dissection forum. Stage B) semi-structured 30-minute interviews with eight MC players.	• Stage A - 5 threads were requesting for technical information, 12 were expressing strategic information, and 3 endeavoured to share opinions. 98.75 days were the average duration of threads. • Stage B - 5 of interviewees reported they get information from MC -focus resources, used the trial and error process to learn, reporting a different way of evaluating information.	8
Callaghan (2016)	Investigating the role of MC Edu in collaborative educational learning environments	Two separate worlds created on MCEdu. One created for learning for the Technology Applied Studies (TAS) class and the other for socialization for an MC club (after school club).	168 (12-16)	Observations using a framework to record classroom information data observed all online activity in real time and using video recording software. An online questionnaire was given for students, with Likert scales and open-ended questions.	• MCEdu used as part of the teaching and learning by 62% of participants. 72% of students reported the educational benefits of using MCEdu in class. The more students vocalized, the more they became productive in building structures collaboratively. • Teacher and researcher reported that players were generous in sharing expertise, communicating, creating objects, problem-solving, and working collaboratively. • All students demonstrated higher order skills of “create” and “evaluate” (Bloom’s Taxonomy).	12
Cilauro (2015)*	To attract youth, to have	Participants engaged in planning	5 (N/D)	Staff evaluation of designed library and	• Parents were involved indirectly and understood the online behaviour of their young people.	8

	a role in library programming, creating social interaction opportunities within the community.	for the MC Gaming Day, and they were given a chance to critically review the library space and employ their rules in the virtual library program.		focus groups about their experience in participation in the library gaming program.	• Participants were able to socially interact with others from other ethnicities and cultures, including disadvantaged young people to be socially included in this online game. This became a socially engaged tool in the library. But, Some of them could not fully take part due to lack of access to MC or being unable to be part of the group dialogues, leading to some isolation. • Limitations of the study: - the age of the participants were not reported.	
Davis, Boss and Meas (2018)	Exploring collaboration in MC and factors which support a high quality of collaboration.	Three groups of 2-4 students were invited to build a summer camp together in Mc for one hour.	10 (11-13)	Observation, field notes and transcripts of reordered video of the playing and participants' utterances using an in-depth thematic analysis.	• Most of the players' discussion with each other included talking about gameplay and asking and answering questions. • Participants' communication and discussion during gameplay showed a number of factors that were affecting their ability to achieve joint attention and successful collaboration, such as prior social ties, gaming experience, and responsiveness to other players.	9
Dezuanni et al. (2015)	Exploring how girls undertake practices of curatorship to display their MC knowledge.	Year 3 students and the teacher played MCEdu, in the class, and explored how girls manage curatorship in the playing and discussion of MC.	16 (8-9)	Interviews and focus groups lasted between 15-30 minutes about the girls' use of the MCEdu version and their home and school gameplay.	• Year 3 students showed positive thoughts about the school MC server because of the social interaction, which occurred by seeing each other's screens and by sharing ideas or solving problems. • Playing the game showed many forms of social interaction in the class, such as discussing, sharing, arguing, ignoring and debating. One student did not enjoy the game socially due to not knowing some people on the server.	8
Ellison (2017)*	Examining how the participant (Zack) chose a	Digital storytelling workshop held after school, one hour a	1 (13)	The researcher observed Zack seven times, for one hour	• The child chose to create his digital story using MC, being a sign of how MC is essential to him; he was able to plan and map the story from the beginning to end creatively	7

	topic and created a digital story; and the influence of his racial identities.	week for seven weeks as part of a PTA enrichment club program for students at Zack's school.		each week, creating audio-recorded transcripts from three 30-minute semi-structured and unstructured interviews.	and independently, feeling comfortable operating in MC space. He reported being afforded opportunities to make decisions, problem solve and be a critical thinker within MC worlds. • The study helped researchers understand how race is an important part of the participant, as evidently presented in his digital story, allowing him to build on his literacies, agency, funds of knowledge and identity.	
Hollett and Ehret (2017)	How civic youth can engage in a youth-driven program - Metro: Building Blocks (MBB), provided within a digital media learning lab in an urban public library.	Participants played together on the same server and location (the learning lab) where the budding city planners built components of Metro, sometimes joining from home if unable to physically attend.	3 (12-16)	The analysis was illustrated upon observation, and video recordings of nearly 90 hours of gameplay as well as field notes and interviews with participants.	• Collaboration and engagement were observed. The engagement was desire-driven toward collaborative transit station, more than interest-driven. • Back-and-forth movements between one player and the others took place, assisting them then leaving them to work independently. • The analytical interest of this paper focused on three rhythmic elements: pulsation, reciprocation and oscillation. • This study is useful for considering how program designers, mentors and educators can encourage productive participation. • Limitations of the game/study - all participants were male.	7
Hong-An (2016)	Exploring the use of values generated by prosumers through their production in affinity spaces.	No intervention reported, as researchers aimed at analysing 25 discussion threads.	N/D (N/D)	Content analysing methods was used to investigate the descriptions, discussions and artefacts produced on	• Threads gave players opportunities to exchange news, legal and technical changes to be able to access the game; sharing a narrative or visual experience of MC and giving opinions and suggestions that can offer the game cultural and social gaming exchanges. These threads can be used as self-directed learning and as educational and motivational support for others, as well as an entry point for socialization.	6

				MC affinity space regarding MC.		
Hook et al. (2016)	Examining the influence of evaluative social identity on brand-based social network commitment.	No intervention was reported.	394 (6-14)	Measurements were: Evaluative Social Identity, Negative Anticipated Emotions, Positive Anticipated Emotions, Community Commitment and Recommendations, Personal Self-esteem, Perceived Behavioural Control.	• Evaluative social identity and network recommendations are positively associated, where a higher level of evaluative social identity leads to a higher level of network commitment. • Children with high evaluative social identity showed positive feelings and emotions when they were able to interact with the brand-based social network, leading children to network commitment and network recommendations. They felt negative emotions when they were prevented from connecting to the brand-based social network.	12
Mavoa, Carter and Gibbs (2018)	Examining engagement with MC for children aged 3-12 living in Melbourne.	No intervention was reported.	753 (children= 3-12; parents= 36-45)	A questionnaire filled by parents to collect data about the children's demographic information, general digital gameplay, Minecraft gameplay, YouTube use, general 'screen time' and finally basic parents' demographic questions.	• Almost 50% of children had played MC in the month prior to filling the survey. Older children are more likely to play MC than younger; boys in the youngest group 3-5 play MC 3 to 5 time more than girls; but older group 9-12, girls play MC more than boys (they drop off from 72% of all boys at 9-11 years old to 54% of boys aged 11-12 years old); 46% of parents reported that children start to play MC at age 6 or 7 years old; a lot of children play less than one hour a day; children that play MC in single player mode play more often; most children play in creative mode; and 37% of children watch YouTube related to MC.	13
Nebel et al. (2016a)	Finding out if social competition increases	Researchers built one world for each of the four groups. They created a	115 (18-42)	A pre-survey and post-survey for cognitive load measurement, the revised User	• The extraneous load was reported by players in the social competition due to the increase in effort in working with the group, but no differences in satisfaction could be observed.	12

	cognitive load, engagement, interest and subsequently learning.	learning task, tested the environment and gave participants a tutorial for the task.		Engagement Scale, the Situational Interest, and also completed the Game Experience Questionnaire.	• A higher number of competitors decreased some engagement because of distracting each other, but higher challenges were positively related to the better level of engagement. • Players in the competitive scenarios learned significantly less.	
Nebel, Schneider, Beege, et al. (2017)*	To evaluate the level of cooperation on learning, play, cognitive load, efficiency, and play experience.	Participants were divided randomly into two groups: voluntary cooperation (VC) and increased task interdependence (ITI), where collaboration was necessary to solve the task.	56 (15-20)	A survey about the experience and pattern of playing of MC. Texts were analysed according to the task criteria and speaking time. Cognitive Load was used, and standardized learning measurements were used as learning performance indicators.	• MC offers players more opportunities for creativity, and they were pleasant, and only positive feedback was yielded. • Students' group task performance increased as they were required to collaborate, so individual learning outcomes increased as their interaction increased. Cognitive load was not affected by the collaboration requirement, but collaboration was used to enable learning, and more mental effort was invested by the ITI group due to the cooperative requirement. • Limitations of the game - some players lose their attention easily and do their own gaming, delaying the process of the given task.	12
Niemeyer and Gerber (2015)	Exploring the phenomena of digital maker culture by examining five MC channels on YouTube.	No intervention was reported.	1 (N/D)	Researchers interviewed an avid player about best channels for MC maker culture, subscribed to 5, reviewed 10 videos from each channel, and then analysed comments.	• All videos provided something to the viewer, such as how to complete a task or build something; some players expressed their own experience of creating something. • Creators and viewers engaged in lengthy discussions. • Creators showed a high quality of MC knowledge and video production. • Limitations - lack of information about the reviewed channels.	8

Potts (2015)	Exploring the impact of popular MC players on the language and interactions of the fan community.	No intervention was reported.	1 (30)	Three data collection sources used: 63 YouTube videos, comments on these videos, and an interview with one of the famous YouTube channels producer in the UK.	• Sexual innuendo was the most frequent themes using a different linguistic tactic. References to romantic acts and feelings in a relationship were also observed, at male gaming partners. • Highest frequent sexual themes in comments were whether they were gay or straight, masculine or feminine. • The anonymity offered by MC allows players to blur and utilize their characters, which can be used to promote social justice and offer a transgressive engagement in the digital world.	7
Sanz-Martos, Martínez-Martínez and Creus (2018)	To analyse users' behaviour, the amount and content of messages and compare the structures and workings of MC and League of Legends (LOL)	No intervention was reported.	N/D (N/D)	Content analysing methods used for messages of two famous YouTube channels	• There is different behaviour depending on the communication space. Mundo-MC community recognise each other and even inform others if one planned to be absent for a while; conversely to YouTube where participants follow any user, and it is not necessary to be subscribed to the channel. • The interest in the topic remains as it is. Members of the community tend to be grouped into teams of acquaintances. They find the game's form is a place for exchanges of messages and information. • Although the number of viewers and the unorganized arrangement of the comments prevents the establishment of a community, there was enough evidence that users shared and exchanged knowledge, and they undoubtedly learn.	6
Schneier and Taylor (2018)	To examine the collaborative engagement of MC players.	Participants were divided into groups and allowed to play MC Pocket Edition for 30-60 minutes.	10 (Avg. 16, *SD*= 10.88)	Participatory observation of both on- and off-screen activity for participants playing	• Players remained active in the game, but their body positioning was largely consistent through the play, same seated positions facing screens.	9

				MC to discuss players' engagements with MC.	• All players engaged with each other in the play sessions with MC PE and social and emotional interactions were observed.	
Stone, Mills and Saggers (2019).	To report on the support for social interactions received by three students with ASD through Minecraft	No intervention was reported.	3 (9-10)	Data collected through screen observations of children playing Minecraft and semi-structured interviews	• MC provide platforms for students to engage in reciprocal conversations. Attracting others' attention, communicating and engaging with others physically and in the virtual worlds was observed. • Playing MC with others provides opportunities for social interactions in multimodal ways that are not available in face to face and offline contexts. The game could be used to promote children with ASD to initiate and sustain social interactions in inclusive educational settings.	10
Willett (2018)	Understanding the ways social aspects of consuming media contribute to meaning-making practices.	No intervention was reported.	6 (8-9)	Semi-structured interviews with children, and one with parents about participants' understandings of online games and gaming resources and sociocultural influences of online games.	• Children showed a general understanding of the gaming industry, due to their investments in membership, realms, merchandise of games. They were aware of numerous revenue-generating mechanisms and learn about financial aspects including critical evaluation of the games' income through social resources, such as older siblings, friends and parents. Socio-economic and cultural contexts of families and parental interests affect online gaming's influence on children's media literacy skills. • Limitations of the study: the sample size is small.	8

* Academic and motivation for learning is a secondary outcome for these studies.

4.4.3 Learning Social Skills in Minecraft

The previous section provided a presentation about the use of Minecraft for academic learning, with most studies highlighting that it was useful for academic and social learning. Schneier and Taylor (2018) observed that players engaged with each other in the play sessions and healthy social and emotional interactions were observed. MC, indeed, helped children with ASD to engage in reciprocal conversations, attracting others' attention, and engaging with others physically and in the virtual worlds, which is important to fulfil their needs (Stone et al., 2019). Similarly, through Minecraft, children demonstrated an understanding of literacy potential for impacting families and society, showing critical awareness of social inequality and prejudice in sociocultural interaction (Marlatt, 2018a). In addition, Hook, Baxter and Kulczynski (2016) indicated that children with high evaluative social identities experienced positive feelings and emotions when they were able to interact with the brand-based social network and felt negative emotions when they were prevented from connecting with others.

Callaghan (2016), furthermore, stated that the teacher reported that the players of Minecraft in the study intervention were collaborative in sharing expertise, creating objects, solving problems, or completing a build; the more students vocalised, the more productive they became. The teacher also reported that her relationships with students had strengthened as a result of being online with them (Callaghan, 2016). Moreover, Nebel, Schneider and Rey (2016) showed that lowered focused attention, significant higher cognitive load, extraneous and intrinsic load increase induced by social competition, and an increase in learning in the solo condition was observed. An extraneous load was reported by the players in the social competition because of the increased effort in working within a group environment. An increased intrinsic load for the classroom social competition was observed compared to solo play, which might be plausible due to the given intrinsic load, as it is influenced by the interaction of the learning material (Nebel et al., 2016). However, no differences in satisfaction were observed, which might be because not every participant appeared to be challenged with an equally skilled competitor or the learning topic was not

challenging (Nebel et al., 2016). Interestingly, the results of the group variation highlighted that monitoring other players caused adverse effects, and players in the competitive scenarios learned significantly less from their environment (Nebel et al., 2016). When the number of competitors is higher, some elements of engagement were decreased because they can distract each other, but higher challenges were positively related to a better level of engagement (Nebel et al., 2016).

Despite that improving social skills might not be the aim of researching Minecraft, their enhancement can be a positive outcome. For example, although players have reported that YouTube and books are the primary resources for obtaining ideas about how to play and be creative, participants indicated that Minecraft helped them to collaborate with others, engage in discussions, and share knowledge of the game with friends, contributing to developing social skills between players (Petry, 2018). Indeed, 37% of children watch YouTube related to MC (Mavoa et al., 2018). Sanz-Martos, Martínez-Martínez and Creus (2018) studied the sense of online community and behaviour in an online discussion platform. They reported that there was different behaviour depending on the communication space, but that the MC community recognise each other and even inform others if one planned to be absent for a while, conversely to YouTube where participants follow any user, and it is not necessary to be subscribed to the channel. The study also found that members of the community tend to be grouped into teams of acquaintances, and they find the form of the games is a place for exchanges of messages and information. The researchers (Sanz-Martos et al., 2018) concluded that although the number of viewers and the unorganized arrangement of the comments prevents the establishment of a community, there was enough evidence that users shared and exchanged knowledge, and they undoubtedly learn.

Furthermore, Niemeyer and Gerber (2015) found that sharing videos of play experiences via YouTube provided something to the viewer, such as how to complete a task, how to create a server, or how to build or craft something within the game. Some players expressed their own preference on how to build something, which allowed other players to enhance their gameplay, while others engaged in

discussions about tasks, as well as exchanging feedback and ideas, with creators providing informative and entertaining comments (Niemeyer & Gerber, 2015). Similarly, Bebbington and Vellino (2015) reviewed and analysed the online discussion platform and reported that five threads were posted as a request for technical information, twelve threads aimed to express strategic information and three endeavoured to learn about others' opinions. In addition, Hong-An (2016) undertook a similar project analysing 25 discussion threads. The researcher indicated that threads gave players opportunities to exchange news and legal and technical changes and to share a narrative, visual opinions, cultural and gaming experiences of Minecraft, and acted as self-directed learning, educational, and motivational support for others (Hong-An, 2016). Furthermore, Davis, Boss and Meas (2018) reported that participants' communication and discussion during gameplay showed a number of factors that affected their ability to achieve joint attention and successful collaboration, such as prior social ties, gaming experience and responsiveness to other players. These actions of exchanging and sharing knowledge, as well as interaction, could help players expand their problem-solving skills and encourage collaborative group learning.

Fostering and maintaining the sharing feeling and providing opportunities for communication and collaboration with others presented an advantage in using Minecraft in the classroom. For example, according to Hill (2015), all players reported positive learning in the digital citizenship library game. Their feelings ranged from being nervous to excited, showing unique evidence of personal interest. Furthermore, Wernholm and Vigmo (2015) found that children expressed annoyance when experiencing a technological problem, expressing and communicating this to each other during the game as meta-conversations. Playing Minecraft with others resulted in many forms of social and communication interaction in the class, such as discussing, sharing, arguing and debating (Dezuanni et al., 2015). Although communication and collaboration with others might not constitute the main reason for playing Minecraft, it can be used to develop players' communication and relationship skills, which are necessary for developing children's life skills. Hill (2015)

reported that Minecraft players were able to share and adapt their own skills through healthy team communications, and substantial evidence of engagement and collaboration within the team. Critical thinking in constructing the virtual works was observed from students who successfully embedded digital citizenship into an immersive learning environment (Hill, 2015). When enjoying an educational activity, learners can develop collaboration skills without aiming to do so (Quiring, 2015). Additionally, Smolčec and Smolčec (2014) stated that Minecraft helped participants to build friendship skills and develop team skills, aiding players to improve peer-tutoring techniques. As such, it could be considered as being an instrument that brought players together to practise communication and collaboration skills in the pursuit of an activity.

Therefore, collaborative (not competitive) learning is a key for a successful education system. The task performance of student groups increased when they were required to collaborate, with individual learning outcomes and interactions increasing, and collaboration was used to enable learning (Nebel et al., 2017a). Asking for collaboration or help was also observable in some Minecraft studies. Dezuanni et al. (2015) found that two of the girls participating in this study were perceived as technical experts, and one of them moved around the class many times offering help to others. Asking for help and offering help appeared to be necessary for improving the communicative and collaborative skills taught to students in schools. However, using Minecraft as a tool to maintain learners' collaborative and communicative skills was not enough by itself. Dezuanni et al. (2015) highlighted that, although players started to show progress towards the learning levels, some children veered off-topic. This could count as one of the limitations, as Minecraft may present too many distractions for some players.

Leadership skills are important qualities that students need to develop to enhance their confidence and self-esteem; Minecraft is reported as a useful vehicle to this end. Elliott (2014) found that the participant's enthusiasm for school improved due to being involved with Minecraft. Students were now seeking his help for guidance and instruction in the game (Elliott, 2014), where Minecraft changed the student's status

among his peers as he became a leader and a significant person in this activity. Hollett and Ehret (2017) also reported that back-and-forth movements between one player and another were positive, where one assists them on their project before leaving them to take on the rest of the project independently. The player considered himself to be a teacher developing an initial pedagogy for newcomers and became self-reliant (Hollett & Ehret, 2017), where he viewed himself as a potential mentor in Minecraft communities. Indeed, leadership skills might be tested and assessed through Minecraft. Therefore, Minecraft allows researchers to develop students' skills, such as their confidence and self-esteem.

4.5 Discussion and Limitations

Although this review demonstrates that Minecraft presents many educational advantages, a variety of issues have also arisen. McColgan et al. (2018) reported that pre-service teachers mentioned five barriers, including the steep learning curve, time, and complexity for teachers, student distractibility, and complexity for students to learn the game; indeed, pre-service teachers were sceptical of using games for teaching in the classroom. This review also summarized some of the limitations reported by previous studies, such as the generalizability of learning lessons to the environment outside the game, Internet connectivity and suitability, possible side-effects of using games in schools, Minecraft age appropriateness, and addiction and health concerns.

The generalisation is a critical issue in teaching a skill through Minecraft. It is debatable as to whether students can apply what they learn through computer games to the real world. In fact, the concept of reality is another questionable issue in computer games. Quiring's study (2015) argued that "the video game world of Minecraft features physical and social places that, while digital, are no less real or meaningful than those outside the game" (p.14). This author supports that Minecraft is a depiction of real life, so players may imagine it is real, helping them to apply learned skills in real life. Previous research gaps and flaws will affect generalisability.

Internet connectivity and suitability presented one of the greatest concerns uncovered by researchers. For example, Cipollone et al. (2014) complained that the teacher in his study was not a technology supporter and was concerned about America's formal education perspective, which might not support tools like Minecraft. Furthermore, social familiarity was another issue in multiplayer games as one student reported that she did not enjoy playing Minecraft, because there were some people on the server that she did not know; however, other students in the study showed positive thoughts because of the social interaction, which was safely observed (Dezuanni et al., 2015). Thus, although technology makes online social interaction more accessible, contact with unfamiliar people might be an issue. Craft (2016) stated that some students who used Minecraft felt overwhelmed; however, after making some iterations, such as including step-by-step instructions of the task to students, confidence in the use of Minecraft increased. The researcher stated, "I find that the best part of implementations of this sort is that we are educating our students about technology, a medium all too familiar to today's generation" (Craft, 2016, p.362). However, because Minecraft is an open world, some players lost attention easily, which may have delayed the task's process (Nebel et al., 2017a). Therefore, making sure that the environment is safe and enjoyable for all students is a requirement in order to make learning more interactive and meaningful.

Digital games such as Minecraft, incorporate many distractions and users should be aware of how to avoid them. Some players may get distracted by the features of the game and lose focus on what they have been asked to do. One player in Hill's study (2015) was distracted on so many occasions that he was removed from the team for two weeks until he promised to follow the team's desired goals, which he later achieved. Another example is when some of the participants mistakenly moved other people's blocks, which caused anger, but they apologised and worked well to fix the area. Therefore, some of the individual problems that arise in gaming can be easily solved; however, the issue becomes difficult when the problems affect the whole project or the whole class. Hill (2015) reported that after a month of working on a library project, the librarian's laptop crashed and the whole project was lost; the

players were disappointed because of the loss of the server, which meant they had to rebuild the virtual library again. After the end of the project, researchers reported that the feedback from all testers was positive. Teachers can help prevent distractions by properly introducing the game and using mods to exclude unrelated features.

Nevertheless, Minecraft might not be a suitable tool for all ages; therefore, researchers need to be aware of age appropriateness before implementing a study. Some research considers the age appropriateness of Minecraft a limitation because it may display some violence (Mavoa, Carter & Gibbs, 2017). The controversy is whether the game is child-friendly or contains violence. What is the definition of violence? Is killing a sheep to consume its meat considered violence? This is a grey area that researchers and parents might interpret differently. The ongoing debate concerning Minecraft and violence seems to be based on unproven cases. It should be noted that Minecraft can be used in a variety of modes, such as choosing the creative mode, where the players do not need to eat meat; therefore, there is no need to kill animals. On the other hand, according to Willett (2015), the Entertainment Software Rating Board (ESRB) rates the game as suitable for children aged ten years and above, while the Pan European Game Information (PEGI) system rated Minecraft as appropriate for children aged seven years and older (PEGI, 2016). However, Mavoa et al. (2018) reported that children as young as three years old play MC, but older children are more likely to play MC than younger ones; indeed, 46% of parents reported that children start to play MC at age six or seven. Willett (2018) investigated the social aspects of 'consuming media' from six children aged eight to nine and reported that the children exhibited a general understanding of the gaming industry due to their investments in memberships, realms, and the merchandise of games. Furthermore, sexual content has been discussed by Potts (2015), whose research analysed videos posted by Minecraft players on YouTube and reported that the number of sexual references or innuendos was very high; references to sex or gender relationships mostly involved sexual innuendo, sexual activity and nudity. Therefore, it is crucial to investigate the impact of the game on teenage players and

their personal privacy and safety, and what measures could be taken to prevent inappropriate sexual content.

Addiction and health concerns were addressed in previous research, and parents and teachers seemed to be able to prevent these limitations by planning the activity. For example, Smolčec and Smolčec (2014) stated that they had a concern about addiction, where players may spend so much time playing the game that it could reduce time spent in developing their physical or social skills and improving their general knowledge. However, the researchers stated that they witnessed their son crafting and doing things that were useful in Minecraft, and this led to positive outcomes in language and collaboration skills. Furthermore, about a quarter of non-players in Callaghan's study (2016) were concerned about game addiction and time-wasting. However, the teacher and researcher did not see any time wasted during the lesson; in fact, the teacher reported that by using MinecraftEdu, students became more productive, engaged and willing to complete desired tasks. Players were interested in launching their work in MinecraftEdu immediately upon entering the classroom (Callaghan, 2016). Moreover, Schneier and Taylor (2018) reported that although players remained active within the game environment, their body positioning was mostly consistent through the play, being the same seated positions facing screens, which may raise a concern regarding their physical health. Further research is encouraged to investigate Minecraft addiction and whether it has an impact on physical or mental health.

In summary, Minecraft attracts the attention of students from different demographic backgrounds and stimulates learning. It allows them to work towards the accomplishment of their goals. However, it is impossible to state definitively whether Minecraft is a good or bad influence because its efficacy should be considered based on the context of where and how it is used. From one point of view, there is a level of risk in playing Minecraft. However, risks exist everywhere, such as attendance at school, in online material, and in schoolbooks, so teaching children to be safe is always necessary, regardless of the educational methods teachers use. In general, Minecraft can facilitate communication and interaction between the learner players

and learning content. Concerns were raised due to the lack of experimental and controlled research conditions, which cannot be fully met due to many social and cultural factors; as a result, it is hard to generalise about Minecraft in learning.

The reviewed studies have some limitations and weaknesses that are imperative to understand because it encourages further areas of research. This critique does not reduce the value of these articles, but it will highlight factors that teachers and school leaders need to be aware of because these might affect the generalisability of some of these articles. Some articles lack detail on the research design. For example, Elliott (2014) used Minecraft in a classroom to develop a curriculum, but the research mentioned only one student. Readers might question the impact of the game on other students and whether the game changed the whole classroom environment or impacted on only the reported student. Some research lacks information about the participants (Bebbington & Vellino, 2015; Cilauro, 2015; Dezuanni et al., 2015; Schneier & Taylor, 2018), while other research has missing information about the project (Dezuanni et al., 2015). This missing information is vital for reusing the criteria in another setting. Furthermore, some research was conducted in two different countries. Although this might be counted as an advantage, researchers did not explain whether there was a difference between the performance of the two groups (Sáez-López et al., 2015), as the game and the intervention might be understood differently due to cultural differences. It would be preferable for further research to examine the cultural value of using Minecraft for educational purposes. Moreover, Cilauro (2015) did not state whether the participants that day had performed similarly to or differently from each other, nor what kind of libraries the participants had built by the end of that day. Another example would be the research conducted by Cipollone et al. (2014), where the authors did not clearly describe the results: researchers blamed the teacher and the institution as they prevented the full implementation of the research. Further research is encouraged to translate the observation notes to statements, helping readers to learn the outcomes of the intervention more easily. Overall, it is paramount that the results section is clear and covers all the mentioned elements, regardless of the outcomes. None of the articles

in this review mentioned whether there was a difference between playing Minecraft as a multiplayer or a single-player game, although previous systematic reviews of digital games, in general, reported that playing a multiplayer computer game had more of an effect on students' learning (Clark et al., 2015). There has been no study on whether it is different playing together in one place or playing together at a distance. This information might be helpful, especially for teaching online programs and offering online support for learners.

Some of the reviewed studies have issues related to sampling. For example, Wernholm and Vigmo (2015) had a sample of three children, but the researchers did not give a clear description of the participants, such as their gender, age, school grade, IQ or level of expertise in the game. It is not clear whether the players were already friends. This information might be imperative because all the previously mentioned factors could affect the implementation of Minecraft. This could be an advantage because the participants' information matters for future researchers who want to apply the intervention in their classroom. Another issue was the number of participants in the research. Most of the research embraced either a very small number of participants (Elliott, 2014; Ellison, 2017; Potts, 2015; Marlatt, 2018a, 2018b; Smolčec & Smolčec, 2014; Swier, 2014; Wernholm & Vigmo, 2015; Willett, 2018), did not mention their age (Cilauro, 2015), or had a gender bias (Hollett & Ehret, 2017). For example, Bebbington and Vellino (2015) interviewed eight participants, but only one was female. Overall, a sample issue does not signify an entirely negative aspect of the research, but it might affect its generalisation because the situation might be different when applying the game to a larger number of students in a classroom.

In summary, due to the previously mentioned weaknesses and limitations, further research is needed in order to provide parents, teachers and school leaders with effective strategies to improve the use of Minecraft in the classroom. More research is needed to investigate parents' perspectives on the game and their possible involvement in further interventions. There is a need for further research to examine the short-term and long-term outcomes of Minecraft in the classroom for students'

future life skills. An appropriate age is another critical area that teachers need to consider before implementing Minecraft in the classroom. Overall, a suitable environment is essential for the successful implementation of Minecraft, which is strongly suggested in order to improve the learning and knowledge of students.

4.6 MC Usage among those with ASD

None of the included studies in the systematic review included children with ASD, which is an important scope of the thesis. Also, none of the included studies mentioned the use of Autcraft. However, some of the excluded papers presented some information about ASD and the use of Autcraft, which are presented in this section as they are very important to the work of this thesis. Children with ASD have a special interest in MC because it offers a space for creative building and exploring (Rozema, 2018). Children with ASD have reported that MC gave them space for social interaction through the multiplayer servers and showed better fluency with the technical part of the game (Rozema, 2018; Ringland, 2018).

Autcraft is a platform of MC, founded in 2013 and created by Stuart Duncan who had been diagnosed with ASD and has a child with ASD. The server is controlled and supervised by people with ASD, parents of children with ASD, or people who have a connection to autism. In November 2018, the Autcraft website stated: “Currently the server has over 9,000 players on the whitelist with an average of 1,200 unique players on the server each month”. Autcraft has some special features: violence and swearing are not tolerated, players are protected by admins, and most activities are tracked. Players in Autcraft create a space for sensory regulation for players who struggle with sensory stimulation, and “members interacting within the Autcraft community do not seem to have a problem with the overwhelming amount of choices given to them both within the Autcraft virtual world interface, and throughout the various platforms the community uses” (Ringland, Wolf, Boyd, Baldwin & Hayes, 2016a, p.37). Thus, Autcraft seems to be a great environment for children with ASD as all players understand this condition and share an interest.

Since there are many studies that investigated the use of virtual worlds by children and young people, Ringland, Wolf, Dombrowski and Hayes (2015) explored and expressed how parents of children with ASD make and manage a safe environment through Autcraft. Autcraft "seeks to be a place for children with autism to learn appropriate social skills and relationships with other children, and therefore, the administrators have created structured social skill interventions throughout the world" (Ringland et al., 2015, p.1795). Autcraft used 'Peaceful Survival World' mode where players play, interact and communicate with each other under their parents' observation (Ringland, 2018). Therefore, maintaining social interaction through Autcraft seems to be common among children with ASD.

Ringland et al. (2016a) undertook their study to examine how people with ASD have used assistive technology for adapting activities in Autcraft through analysing about eighty hours of observation, 150 blog posts and more than 5000 forum threads. They found that players used mods to support their self-regulation and community engagement. They also found that players collaborated well, using their expertise to help each other when one member decided to do something, such as building work. Players were able to express and share their emotional feelings safely with others, and teleport to their home when they needed to (Ringland et al., 2016a). These findings are important to the field of ASD research because sharing feelings is an important key to developing relationships with others, as well as expressing feelings of safety, both of which help children to understand their self and their uniqueness in order to become an active learner; thus, identifying the social and personal identity in the education community seems to be vital.

Ringland, Wolf, Faucett, Dombrowski and Hayes (2016b) studied communication ecology appearing around Autcraft for children with ASD and their partners using ethnographic methods and reported that members (players) of the community (Autcraft) show social and communicative interaction, identifying and practising sociality. Children found Autcraft to be an innovative tool to express their selves and create a sense of community. The study highlighted that online communities could serve as a tool for sociality where individuals seek out opportunities for social

interaction. Some of the participants stated that their involvements in Autcraft are socially driven. Researchers (Ringland et al., 2016b, p.1263) stated:

> Autcraft provides powerful common ground for players, a key foundation to many friendships. Not only do those who join the community share a common interest in Minecraft, they also all have claimed to be either an ally of, or someone with, autism. […] The shared space of the Autcraft server facilitates making new acquaintances with some assurance that you have some commonality. In-game chatting, text-based communication out of game, gift giving, and shared activities work together to enable players to strengthen the bonds of friendship.

Furthermore, Mu and Sin (2018) examine the benefits and challenges of using Minecraft in teaching students with autism in two Chinese-speaking special schools in Hong Kong. The researchers reported that MC have positive impacts on how children with ASD learn, especially in rising their engagements with the learning content, improving their collaboration and communication skills, and developing their relationship with teachers and classmates. Therefore, MC is useful to be used alongside other educational and social intervention for children with ASD.

To conclude, MC and its special version for children with ASD, Autcraft, have been found to be useful and capture children's interest for three main reasons: they constitute a world of creative possibilities (Rozema, 2018), give them freedom to express and share their emotions, feelings and interests safely (Ringland et al., 2015; Ringland et al., 2016a), and provide them with a safe space for social interaction (Ringland et al., 2016b). Thus, in this thesis, the role of MC in children's mental health, and especially peers' relationships for children with ASD will be investigated.

4.7 Chapter Conclusion

The benefits of MC to social skills and academic learning outweigh the disadvantages. Evidence of included scholar peer-reviewed studies indicated that MC was very helpful in developing the social skills and academic learning of players. The

multiplayer mode offers players the ability to collaborate in such a project and to interact and communicate socially as much as they wish. On the other hand, some limitations were reported, such as age appropriateness, time-management in using MC in classrooms, and students' attraction to the desired goal. A closer look at its limitations and disadvantages show that they tended to be as a result of inadequate preparation, the unclear purpose of the use, and a lack of knowledge of MC. Negative outcomes can be eliminated by planning well and providing better assistance to teachers, parents and children. Overall, the game world is very similar to the real world, where there are some positive and negative consequences.

As there is no identifiable study about how MC might have an impact on developing relationship skills and assisting with mental health problems for children with ASD or HL, this thesis hypothesises that MC is a useful tool for developing children's relationships skills and improving their mental health status. This assumption is constructed based on several studies that found MC is generally helpful in improving players' social skills, such as sharing and collaboration skills, and communication and engagement skills. Thus, in this thesis seeks to expose the association between MC and social-emotional and behavioural outcomes of MC for children with ASD and/or HL, as no research has yet attempted to understand the impact of MC on children's relationship skills and mental health status.

4.8 This Thesis' Questions and Hypotheses

As previously mentioned and based on the identified gap in the systematic review, the purpose of this research was, firstly, to recognise and identify the norms of OCG, and MC in particular, among children with special needs; secondly, to examine the role of these games in respect of mental health; and thirdly, to investigate the extent to which these have an impact on relationship skills. On this basis, three research questions were formulated:

1) Do children with ASD or HL play OCG, and specifically MC, more than TD children across the UK and KSA sample?
2) Whether there is an association between playing MC and children's social-emotional and behavioural outcomes?
3) Whether there is an association between the frequency of playing MC with others and players peer relationship problems score.

This study also offers three testable hypotheses:

1. Children with ASD or HL play MC more than TD.
2. The scores of the frequency of playing OCG, lifetime duration of playing MC, and MC frequency are associated with the SDQ scores.
3. The score of playing MC with others is associated with peer relationship problems score.

The process of data collection methods is described in detail in Chapter 5, the demographic information about the sample is presented in Chapter 6, and then a presentation of these hypotheses testing are presented in Chapters 7, 8 and 9.

CHAPTER 5: RESEARCH METHODOLOGY

5.1 Introduction

This chapter describes the research methodology used to conduct this study. First, its research philosophy is discussed in § 5.2. The researcher's ontological and epistemological positions are disclosed and discussed, as they influenced the chosen methodological approach. Information about the study design and the participants is presented in § 5.3, together with a description of the mixed methods and questionnaires used for data collection. The procedures used to collect the data are explained in § 5.4. After that, data analysis producers for both the quantitative and qualitative data are explained in § 5.5. Finally, § 5.6 identifies ethical considerations for the research before § 5.7 gives an overview of the chapter.

5.2 Research Philosophy and Paradigms

It is critical to distinguish between research philosophy and research paradigms. According to Sefotho (2015), philosophy is the broader concept and is the foundation of research paradigms. Thus, it is essential to outline the philosophical assumptions of any research project. Philosophies aim to show thoughtful critiques of our beliefs and assumptions, to search for a better understanding of life, and to engage with specific questions not covered by other disciplines (Brennen, 1999). The three main philosophies of thought used in education today are summarized in Table 5.1

Research cannot be entirely objective due to individuals' natural differences of experience and implicit cultural values and beliefs. It is inevitably influenced by the researcher's assumptions, choices, belief and philosophical choices (Blaikie, 2009). Therefore, in Table 5.2, the research paradigms that are influenced by the philosophical positions above are presented to summarize the most common ones in educational research: positivism, interpretivism and pragmatism.

Table 5.1: Summary of the three main philosophical positions in contemporary Education research

	Realism	***Idealism***	***Pragmatism***
Father of the Philosophical Position	Henrik Ibsen	Plato	Charles Sanders Peirce & John Dewey (modern Pragmatism)
Reality	Physical objects	A world of the mind	What can be experienced
Truth or knowledge	Correspondence and sensation	Ideas	What works
Teaching ontology	Subjects of the physical world	Subjects of literature philosophy, religion	Subjects of social experiences
Teaching epistemology	Teaching for proficiency of information	Teaching ideas through lectures, discussion, and Socratic dialogue	Problem-solving; adapting to the environment
Teaching values	Rules of conduct, behaviour, action	Heroes and examples	Consequences
Curriculum	Facts & basic skills; laws of physical reality; standardised & scientific	Literature, history, philosophy, and religion	Explore society and share experience
Teacher role	Present & transmit knowledge	Reporter	Consultant; facilitator
Student role	Passive participation	Receive & memorise	Active participation
Change	Always, moving toward perfection	Anti-change; the truth is protected	Always, a process of evolution

Summarized from: Brennen, 1999; Creswell, 2013; Kivinen & Ristela, 2003; LeoNora, 1999; Sefotho, 2015; Schuh & Barab, 2008; Ormerod, 2006; Ozmon & Craver, 2008

Table 5.2: Summary of the three main research paradigms

	Positivism	*Interpretivism*	*Pragmatism*
Ontology (what)	There is an absolute truth	There are multiple realities created by individuals and groups	Reality is defined differently from a place to another, from time to time, and from a person to another; truths are temporary
Epistemology (how)	Empirical scientific methods	Interpret and define the meaning of reality through participants' view	Use what works to solve the problem
Research process	Starts from a theory	Collects participants' experiences and then develops a pattern of meaning	Based on the researcher's choice
Methodology	Mostly quantitative	Typically qualitative	Usually mixed methods
Methods	E.g., experimental designs; survey research	E.g., grounded theory; action research; case studies; interviews; observations	Use what works to solve the problem
Researcher's role and position	Administrator; should be objective	Investigator and interpreter of participants' experiences	Investigator

Summarized from Creswell, 2013; Sefotho, 2015; Mackenzie & Knipe, 2006

All research paradigms are workable and meaningful regardless of their rules and characteristics. Each of the research paradigms mentioned above could have been selected for this research. However, since the goal of choosing a research paradigm is to show the researcher's philosophical position and research attitudes, pragmatism is suitable and the best paradigm for this study for many reasons as presented in the following paragraphs.

In this thesis, I examine whether or not there is an association between children's MC gameplay and the players' social-emotional and behavioural outcomes, with an emphasis on relationships with others. Pragmatism highlights the importance of experience and sensation and, according to Baldwin (1894, 1906) and Piaget (1953, 1962), knowledge develops through the interaction between the learner and around places, objects and people as well as embodied experiences. In my research, I looked to provide the opportunity for participants to practise and exercise social interaction within a relationship through online gaming. MC is assumed to be a safe environment where players can interact and engage socially (Ringland et al., 2015), which includes people with whom participants have relationships. For Dewey, the experience is the source of knowledge "in the sense that the experienced shock of change is the necessary stimulus to the investigating and comparing which eventually produce knowledge" (Dewey, 1921, p.90). This online environment may allow children to experience being included and sharing interests with other individuals who are the same age or social state.

Pragmatism believes truth is what works for an individual within society (Brennen, 1999); knowledge and truth are temporary (Crotty, 1998; Giacobbi Jr et al., 2005; Johnson & Onwuegbuzie, 2004); and truth helps us to think about the objects of our world: "objects of knowledge are instruments for action, and different objects, different worlds, provide us with different opportunities and possibilities for action" (Biesta & Burbules, 2003, p.108). This is critical in my research because I deal with participants who would be very different from each other. The online gaming environment might be helpful for one person, but not for another person who shares the same abilities. Children with ASD or HL have obvious individual differences due to their specific needs. Also, OCG might not exist later or may undergo significant change. OCG did not exist 50 years ago and might evolve into something else later. Thus, the result of my research may not be a continuous truth because these online games are changing rapidly, and players need to adapt to these changes. Another critical point here is that truth is what works for an individual within society (Brennen, 1999). This project studied the association of the gaming behaviour on players' social

relationships; although this is an individual need, it is important for society as well. Thus, pragmatism provides me with the opportunity to focus on individuals' needs.

Interpretivists support qualitative research methods, whereas positivists support quantitative and empirical research methods. Pragmatists are in the middle, where they support mixed methods (Blaikie, 2009; Crotty, 1998; Feilzer, 2010). I used mixed methods to collect my data. This research is in the middle of deductive and inductive approaches because I have a hypothesis, but the primary goal is not to prove or disprove it. The purpose of this research was to develop our understanding of the online gaming environment and its impact. The pragmatist approach seems to be the middle, seeking to understand individual experience within society through mixed methods (Morgan, 2014). Consequently, there is one element of positivism and another element of interpretivism where I am looking at the participants' experience alongside with statistical pieces of evidence.

5.3 Research Design and Approaches

All educational and psychological research should have a research design that structures the study, which has a powerful impact on methodological choices. The research design is "the plan or strategy you will use to investigate your research questions" (Johnson & Christensen, 2012, p.90). Thus, in this section, an overview of the study location, sample and methods are presented.

The primary aim of this research was to find a prediction or associations between playing OCG, specifically MC, and mental health, with an emphasis on relationship skills. Hence, this research is a correlation study. This type of research is "quite common in special education research because of the frequency of comparison of persons with disabilities and persons without disabilities" (Mertens & McLaughlin, 2004, p.70). Figure 5.1 summarizes the design of this research.

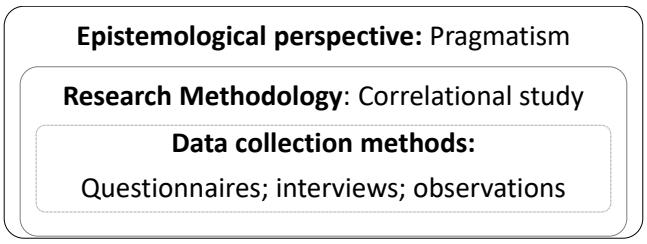


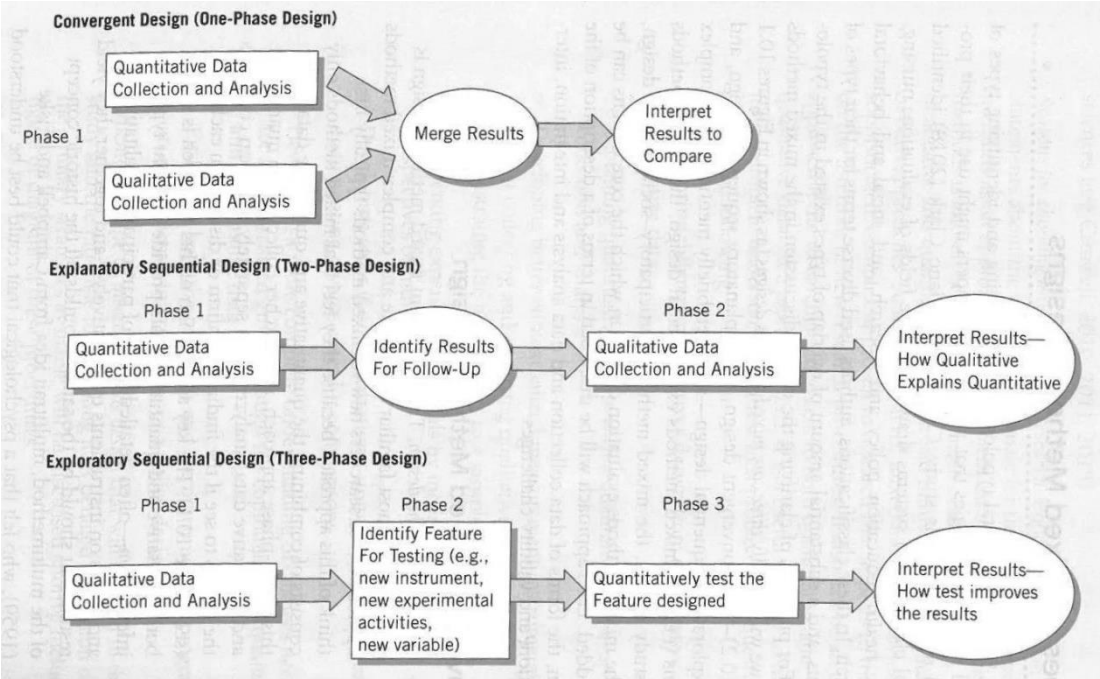
Figure 5.1: Research Design

5.3.1 Mixed Methods in Studies of Special Needs Children

Creswell and Creswell (2018) and Creswell and Clark (2017) identified three main types of mixed methods design (Figure 5.2). The first is the convergent parallel design (one-phase design). The second design is the explanatory sequential design (two-phases design), which aims to use the qualitative approach to explain the quantitative results and the qualitative part depends on the quantitative results. The third is the exploratory sequential design (two-phases design), where the qualitative phase aims to develop or inform the quantitative study. The two main issues with the explanatory sequential design and exploratory sequential design are that it is a two-phase design, which means they are time-consuming and questions whether the two samples (of the two phases or two approaches) are similar to each other. Therefore, the convergent mixed methods design was used for this research.

The convergent mixed methods design is a single-phase approach, where the researcher collects both quantitative and qualitative data together, but analyses them separately, and then uses the results of one to confirm or disconfirm the findings of the other (Creswell & Creswell, 2018). The main theory of this approach is that qualitative and quantitative data afford different outcomes, and the historical idea is that a psychological trait can be understood better by gathering different forms of data (Creswell & Creswell, 2018). Largely, the mixed method research design is selected due to its advantages in reducing the limitations and restrictions of quantitative and qualitative research approaches.

Figure 5.2: Three main types of mixed methods design (Reprinted from Creswell & Creswell 2018, p.218)



There are many reasons for choosing mixed methods for this investigation. For example, this investigation aimed to contribute better to the research problem by converging (or triangulating) quantitative data and discuss it with in-depth qualitative data (Creswell & Creswell, 2018), such as through exploring some participants' views. The benefit of mixed methods research is that it can overcome the weaknesses of quantitative and qualitative research (Caruth, 2013), and provide a developed approach to increasing the research finding's validity with substantial evidence of the finding (Creswell & Clark, 2017; Johnson & Onwuegbuzie, 2004). It also provides in-depth data about the research issue and deep understanding of the investigated phenomenon (Caruth, 2013; Johnson & Onwuegbuzie, 2004), and can be helpful in overcoming the researcher's bias (Creswell & Creswell, 2018).

Therefore, the mixed methods approach was deemed to be needed because of its previously mentioned advantages and because children's playing patterns might be different due to differences in their abilities and backgrounds. Thus, this approach was chosen to increase the research finding's validity. Questionnaires were used to

collect quantitative data for the use of MC and related information from parents, and qualitative data was used (through interviews and observations) to bring useful in-depth information. In the following section, a presentation of each method of approach is briefly discussed.

There are some advantages to using a questionnaire to conduct research. Firstly, questionnaires are less affected by the researcher so that it can provide higher objectivity (Gray, 2014; Sincero, 2012). Questionnaires can be filled in by a significant portion of a group in a short time, and it is easy to be anonymous (Gray, 2014). Some researchers think participants might be more honest in filling in a questionnaire because it can be taken by mail or online without the researcher present (Bailey, 1994; Gray, 2014). Moreover, questionnaires take less time, effort and cost to be administered, analysed and interpreted (Bailey, 1994; Creswell & Creswell, 2018; Wyse, 2012). Questionnaires also can be more affordable because the responses are collected from different geographical places and have stronger generalisability where the researcher can generalize the results to a population (Creswell & Creswell, 2018; Krosnick & Presser, 2010). Therefore, these advantages seem to be ideal for collecting research from a large number of participants. To overcome these shortcomings of using a questionnaire, Jensen (2003), Johnson and Christensen (2012) and Gray (2014) mention outstanding principles that were followed when the questionnaire was designed for this research. First, the questionnaire should match the research questions and objectives, and it should be understandable by the research participants. It should be well written, and it should not use a biased language. Researchers are suggested to use multiple items to measure an abstract concept. Finally, questionnaires should always be piloted. These principles were helpful in designing this research's questionnaire to reduce the questionnaire disadvantages and provide better well-planned producers.

Interviews are a tool for the qualitative approach and are useful and would help the research to collect more in-depth data by understanding the facial and body languages (Bailey, 1994; Johnson & Christensen, 2012; Gray, 2014). In fact, it might be a great tool for collecting information about feelings or attitudes (Gray, 2014). It

can also be more flexible so that the researchers can follow the narrative of an answer, and it provides more information about a complex issue (Bailey, 1994).

Observation, in general, is one of the critical strategies used by researchers globally to monitor the process of learning and skill acquisition. While people utilize their five ordinary senses to perceive issues, observation is the primary sense used by youngsters to understand the events around them (Delafield-Butt & Trevarthen, 2013). Observation also has some advantage that can produce valuable data for this research. It produces more immediate data than other data collection methods, such as self-reports or testing, and it can provide data that may not be included in the survey (Coolican, 2014). Observation provides more information on the real life and in the natural environment (Bailey, 1994; Coolican, 2014). Thus, it would help in building more narrative, qualitative data to explain the relationship between the mental health status and MC playing pattern. Observations might be impacted by the observer and, to overcome this, I have included interviews to gain the players and their parents or guardians' perspectives.

Overall, this investigation used Convergent Mixed Methods Design by converging (or triangulating) quantitative and qualitative data together and using the results of one to confirm or disconfirm the other. This design is used to gain the benefits of each method approached and overcame the weakness of one by using the other, as well as to maximize the research validity. The research sample is discussed next.

5.3.2 Research Sample

The data collection took place in two locations: the United Kingdom (UK) and the Kingdom of Saudi Arabia (KSA). According to Malhotra, Agarwal and Peterson (1996), sample size differs from country to country and from population to another, but it can be determined through many ways such as the nature of the research, sample sizes used in previous and similar studies, and resource limits. The expectation of this research sample size was based on the sizes of previously published studies on MC, mentioned in the systematic review (§ 4.4). The research used non-random sampling techniques. A purposive sampling method was used to collect participants because

the research was looking for a number of participants who are not systematically chosen from the population and because the researcher had already defined the age and estimated number of participants (Johnson & Christensen, 2012). Furthermore, purposive sampling was used because the study design involved cross-cultural groups as well as children with disabilities.

In the first data collection round, the questionnaire was expected to be completed by 100 participants (35 from each condition) from both countries, due to the difficulties of conducting research on children with special needs and in a developing country (an in-depth discussion of some of these difficulties can be found in §5.6 on ethical consideration and in § 11.3 on the thesis limitations). Fortunately, it was filled in by 195 participants from both countries in total. However, the conditions groups were unbalanced, and a second data collection round was needed to match the participants' groups as closely as possible (discussed in § 6.2). Participants in this study had to meet the following criteria: (A) Parents or guardians of children who have been diagnosed with ASD OR HL OR without any disability (TD); AND (B) Parents or guardians of children aged 8 or over who have not made the transition to secondary or high schools.

The second part of this investigation included collecting data through observation and interviews. Nine to twelve participants were expected to take part in the interviews and observations. Parents or guardians of children from KSA were asked (at the end of the questionnaire) whether they were willing to take part in this part, and they were given the Participants Information Sheet (PIS) for the second part. Parents who agreed received a paper copy of the consent form before the observation and interviews. Participants in this study met the criteria mentioned previously (for the questionnaire) AND C) live in the KSA. However, only three parents were interviewed, and four children were observed and then interviewed, and all of them are TD children who have not been identified with any disability. Further discussion of this issue is presented in the section on thesis limitations, §11.3.

Children's age for both parts was chosen due to the following reasons. First, children usually master basic language skills by the age of nine (Peterson et al., 2016).

Language skills are a critical element for peer interaction and relationships, and a significant number of studies identify language skills as the cause of poor social skills. Second, the impact of social difficulties or impairment would be higher at this age because of the need for socialisation according to the social development stages (Tudge & Rogoff, 1999). Third, this age is included in the concrete operational stage, which is in Piaget's theory of cognitive development. At this stage, children should exceed and overcome the egocentrism stage, which refers to the inability to understand others' perspective (Cook & Cook, 2005). Therefore, TD children at this age should be able to understand others' perspective, which is critical for social interaction. The fourth reason is that MC was rated as appropriate for children who are seven years and over by Pan European Game Information (PEGI, 2016). Consequently, this age seems to be particularly appropriate for developing social relationships because most students have already had a connection with each other. Importantly, it is before the age when students leave primary school and transfer to secondary schools, which might affect their relationship with each other, especially for students with ASD who have difficulties to adjust to the schools transition and to adapt to the new school environment (Hannah, 2008, 2009; Hannah & Topping, 2013; Nuske et al., 2018). The impact of the transition from primary to secondary school on students' social and friendship skills found to be painful, unsettling, and stressful socially and emotionally (Hannah et al., 2010; Jindal-Snape & Hannah, 2014; Pratt & George, 2005; Richardson, Jindal-Snape, & Hannah, 2017). Therefore, I only included children who have not reached this transition crisis.

5.3.3 Research Instruments and Procedures

As stated earlier, the data collection comprises four methodological research tools:

1) Questionnaire for parents
2) Interviews for parents
3) Interviews for children
4) Observation

5.3.3.1 Questionnaire

Firstly, the questionnaire was designed for parents or guardians from the UK or KSA. They were given the questionnaire to collect data about their views of their children's current level of relationship skills, mental health and OCG playing activities and patterns. The questionnaire has five sections:

Section 1: Autism Quotient for the child (AQ-10 child) (10 items)

Section 2: The Strengths and Difficulties Questionnaire (SDQ) (25 items)

Section 3: Minecraft playing pattern and history (developed by the researcher)

Part 1: OCG playing pattern and history (6 items)

Part 2: Child's pattern of playing MC in single player mode(10 items)

Part 3: Child's pattern of playing MC in a multiplayer mode (6 items)

Part 4: Overall impact of MC on the child (7 items)

Part 5: Overall impact of other games on the child (8 items)

Section 4: General Information (demographic information) (15 items)

Section 5: Further investigations (3 items)

Display Logic and Skip Logic orders were created and used a survey that was customised to each respondent. When a specific question or answer choice was related to certain respondents, Display Logic was used where the question would not be shown to the respondent unless a certain condition was met. For example, parents or guardians whose children had not played MC had no access to Parts 2, 3 or 4 because these questions were related to MC. And thus, Skip Logic allowed me to send respondents to a future point in the survey based on how they answered a specific question. For example, Part 3 was skipped for parents or guardians whose children had not played MC in a multiplayer mode. All Display and Skip Logic orders are mentioned in the questionnaire in Appendix 2.

Autism Quotient (AQ-10)

The one used in this research is the short form of the Autism Spectrum Quotient (AQ-10), which is a short version of the AQ test with similar prediction ability. The AQ is a screening instrument for autistic traits, developed at the Autism Research Centre

(ARC) at Cambridge University, and is widely used for screening purposes (Baron-Cohen et al., 2001). The questionnaire is self-reported and was validated with a group of adults of average IQ or above. The main aim of the AQ was to test whether an adult has high-functioning autism or Asperger's syndrome (Baron-Cohen et al., 2001; Baron-Cohen et al., 2006). Eighty percent of people who scored 32 or more out of 50 on the AQ tend to have clinical diagnoses with ASD; only 2% of the control group scored above 32. A score of 26–31 is considered to be a borderline indication of ASD. In the study, the average score in the control group was 16.4; men scored slightly higher than women. Thus, people who score 32 and above have a strong probability of having Asperger's syndrome (Baron-Cohen et al., 2001). However, males and scientists in the general population tend to score higher than females or non-scientists (Baron-Cohen et al., 2001). There is also gender disparity between the groups: approximately 60% of the control group were female, and almost 54% of the ASD group members were male, which does not conform to the ASD ratio. Along with this growth in using AQ to screen children with risk of ASD, however, there is increasing concern over whether it has the same effect after the change in the diagnostic criteria. Of particular concern is that the scale points gave the same value for "agree" and "slightly agree" as well as for "disagree" and "slightly disagree" (Allison et al., 2012), which means the questions are yes or no questions and respondents are limited to these two choices.

Research indicates that the AQ is useful for screening of autistic traits in clinical practice (Allison et al., 2012; Austin, 2005; Woodbury-Smith et al., 2005), and has good production of ASD from the Systemizing Quotient-Revised and Empathy Quotient (Wheelwright et al., 2006). In addition, Allison et al. (2012) indicated that AQ is useful across cultures; it has been used among the Dutch population (Hoekstra et al., 2008) and the Italian population (Ruta et al., 2012). However, one study noted that it has some cultural elements that make it hard to generalise outside Western culture (Freeth et al., 2013). Furthermore, some of the questions (applied for all AQ versions) may depend on the situation, so it is hard to agree or disagree without identifying a situation. The AQ also does not distinguish between abilities versus

skills. For instance, some people might be anti-social due to life experiences, not because they have ASD. However, AQ-child is a reliable and valid parent-reported questionnaire that was developed from the adult AQ to quantify the age traits for children between 4 and 11 years old (Auyeung et al., 2008).

AQ-10 (the one used here) was developed based on a study by Allison, Auyeung and Baron-Cohen (2012), which surveyed 1,000 people with ASD (449 adults, 162 adolescents, 432 children and 126 toddlers), and 3,000 typical developing people controls (838 adults, 475 adolescents, 940 children and 754 toddlers). Questions in the AQ-10 are similar to the AQ. They come from five domains: attention to detail, attention switching, communication, imagination and social skills (Allison et al., 2012; Auyeung et al., 2012). The cut-off score for AQ-10 is 6, sensitivity was 0.95, specificity was 0.97, positive predictive value (PPV) was 0.94, and internal consistency was 0.85 on all used measures (Allison et al., 2012). Thus, for the AQ-10, if someone scored above 6 and had suffered from the symptoms, they should be referred for a full ASD evaluation (Booth et al., 2013).

AQ-10 has advantages, such as being short and clinically tested as well as having different age versions and good predictive properties (Allison et al., 2012). However, there are certain drawbacks associated with AQ and AQ-10: it was developed for adults with Asperger's syndrome, which makes it hard to generalise for all people with ASD. Furthermore, although the AQ-10 validation study does not mention IQ, this is assumed to be the same with AQ as the questions were a subset of the AQ, which specified it as a screening tool for people who have an average IQ or above. Taken together, these studies support the notion that AQ-10 is a useful "red flag" tool that can assist the diagnostic referral decision. Thus, the AQ-10 was used to group children in this study for its advantages and these reasons:

- It has excellent sensitivity of 0.95 and specificity of 0.97 (Allison et al., 2012).
- It has been validated.
- It is short, easy to understand, and widely used for screening purposes.
- It can be administered online, and if so, thereby removing the impact of the researcher or observer being present.

Strengths and Difficulties Questionnaire (SDQ)

The Strengths and Difficulties Questionnaire (SDQ) is a brief social-emotional and behavioural screening questionnaire to be filled in by parents, teachers, and carers or by children and adolescents themselves to be used for research, clinical and educational purposes (Goodman, 1997; Goodman & Goodman, 2009). This questionnaire has 25 attributes questions, and 20 questions to generate a total difficulties score for four categories: emotional symptoms, conduct problems, hyperactivity/inattention and peer relationship problems. It also has five questions relating to the strength of prosocial behaviour (Goodman, 1997). Ten of the questions investigate strengths, 14 questions look at difficulties, and one is neutral (Goodman, 1997). Thousands of researchers, clinicians and educationalists have used this questionnaire to investigate social, behavioural and emotional developments with different demographic information (Goodman, Lamping & Ploubidis, 2010; Kersten et al., 2015). The SDQ is part of the Development and Well-Being Assessment (DAWBA) family of mental health measures, which is generated from ICD-10 and DSM-IV psychiatric diagnoses and aims to promote the psychological well-being of people (Goodman, 2001). SDQ has three components, the 25 items, an impact supplement and follow-up questions. The impact supplement asks whether a young person has a problem with the following areas: emotions, concentration, behaviour or being able to get on with other people, and if so, inquires further about the problem chronicity, caused upset or distress, how it interferes with the child's everyday activities, social impairment, and burden to the family as a whole (Goodman, 1997; Goodman & Scott, 1999).

Several studies determined the reliability and validity of the SDQ and reported satisfaction with its five-factor model (Goodman, 2001; Goodman, Meltzer & Bailey, 1998). Pearson correlations of all SDQ versions have been found significant for emotional problems, conduct problems and hyperactivity-inattention subscales (Goodman, 2001). Interrater and test-retest reliabilities were also satisfactory (Goodman, 2001; Stone et al., 2010), but Kersten et al. (2015) raise a concern about the test-retest reliability. Regarding validity, it was found that SDQ correlates strongly

with DSM-IV and the Child Behavior Checklist (Goodman & Scott, 1999; Goodman, 2001; Warnick, Bracken & Kasl, 2008). However, internal consistency was a concern for some researchers, especially regarding the peer relationship of the parents' version (Palmieri & Smith, 2007; Goodman, 2001).

The total difficulty scoring should range between 0 and 40, where the higher score means a higher risk of mental health problems (Goodman & Goodman, 2009). The scoring categories are: normal (0–13), borderline (14–16) and abnormal (17–40) for the total difficulties score; this is based on parents' reporting. For each category, the normal score is 0–3 for emotional problems, 0–2 for peer problems and conduct problems, 0–5 for hyperactivity and 6–10 for the prosocial score. The borderline scoring is 4 for emotional problems, 3 for peer and conduct problems, 6 for hyperactivity and 5 for prosocial scoring. Regarding the abnormal, the scoring is 5–10 for emotional problems, 4–10 for peer and conduct problems, 7–10 for hyperactivity and 0–4 for prosocial scoring. The cut-off was chosen based on the normative data from a large population in the UK, but this score has not been adjusted for age or gender (Goodman, 1997). When scoring the SDQ, we can score the five scales of the SDQ either as a dimension (range 0–10) or as a total score of difficulties (0–40). Another possible alternative scoring is to combine difficulties scales to two main categories: internalising scale (emotional and peer problems) and externalising scale (conduct and hyperactivity scales) (Goodman, Lamping & Ploubidis, 2010). Research suggests using the first scoring option with high-risk groups as it comes with much more discrimination between higher scores (for better detection) and using both scoring approaches with low-risk groups (Goodman et al., 2010).

SDQ has many advantages, including accessibility and affordability. It is brief, easy to score, downloadable and has many versions to fit particular needs. The SDQ is available in many languages, including Arabic, Chinese, French, Finnish, English and Spanish (Goodman & Scott, 1999; Kersten et al., 2015). It also addresses some of the strengths of the children. Furthermore, the SDQ is found to be excellent for longitudinal studies as it measures the same constructs across time (Sosu & Schmidt, 2016; Stone et al., 2010), and has significant psychometric properties (Stone et al.,

2010). However, the SDQ cut-scores were established on a sample from the UK, which may make it hard to use in other countries with the same effect.

In my research, I used the SDQ to determine whether OCG and particularly MC, have any impact on children's social-emotional and behavioural outcomes. Thus, SDQ was employed in this study for the following advantages and reasons:

- The SDQ has been utilised for a while in the UK, which may give it a stable environment, as part of the data was collected from the UK.
- It has several languages including Arabic, so using it was helpful as the study was also carried out in Saudi Arabia. The Arabic version of the SDQ is found to be a valid measure for assessing different behavioural aspects, screening for epidemiological studies, and for clinical assessment as well as it can accurately predict psychiatric diagnosis (Alyahri & Goodman, 2006).
- It has excellent sensitivity and specificity for identified individuals with a psychiatric diagnosis with a specificity of 94.6% (95% Cl, 94.1-95.1%) and a sensitivity of 63.3% (59.7-66.9%) (Goodman et al., 2003).
- SDQ has been validated and has high reliability as mentioned above.
- It has one section about peer relationship problems, which may help as the focus of this research is on relationship skills.
- It is short, easy to understand and affordable.
- Authorisation to use the SDQ was bought on 18 April 2017 (Appendix 2).

Minecraft playing pattern and history (developed by the researcher)

This section of the questionnaire was developed by the researcher and to be filled in by parents (Appendix 2). The Reliability Cronbach's Alpha is presented in the validity and reliability section (§5.3.5). The questionnaire items were ordered based on the flow of asking questions, from very general to specific questions. The questionnaire aims to assess four independent variables (frequency of playing OCG; MC life-time duration and MC frequency; playing MC with others) using a Likert scale (as discussed below). The questionnaire also aims to find the impact of MC on some of the children's lives, based on parents' perspective: emotions, friendships, peer relationships, classroom learning, and participation in the society and community events using a semantic differential scale, a scale of two polar adjectives (positive vs

negative). These factors and outcomes are used as relevant to the aspect of this investigation hypothesis.

This questionnaire has been used to determine six different parts:

a. Playing group (Q3.1, Q2.1, Q1.5_4)
b. Preference for playing alone (Q1.5_1)
c. The frequency of OCG (Q1.5_4)
d. Lifetime duration of playing MC and MC frequency (Q2.3, Q2.4)
e. Playing MC with others (Q3.1)
f. Impact of MC on the children's life (Q4.1, Q4.3, Q4.4, Q4.5, Q4.7)

• **Playing group** (These are categorical factors)

This can be more described as categorising questions rather than scoring. The main aim for these questions is to see which one of the following groups can apply to each one of the participants (playing OCG vs playing MC in a single-player mode vs playing MC in a multiplayer mode). These questions are coded first and respectively according to the following:

a. Q3.1: *Does your child play Minecraft in a multiplayer mode*? If the answer is not missing, or Never or Do not know (DNK), then children are placed in "*playing in a multiplayer mode*" group because that indicated that these children had played MC in a multiplayer mode.

b. Q2.1: *Does your child play Minecraft/Autcraft*? If the answer is not missing, or No or DNK, then children are placed in "*playing in a single mode*" group because that indicated that these children had played MC in a single-player mode but not in a multiplayer mode as shown from the previous question (Q3.1).

c. Q1.5_4: *My child plays OCG*: If the answer is not missing, or Never or DNK, then children are placed in "*playing OCG*" group because that indicated that these children had not played MC as shown from the previous two questions (Q2.1: and Q3.1).

- **Preference for playing alone**

This is one statement that is treated and analysed separately as an ordinal factor. It is related to social play and would allow us to know whether the child likes to play alone or not, and this information would help us to see whether they play with others online in MC. Some children with ASD preferred to play alone – rather than play with others due to social preference (Wolfberg, 2009). Thus, this question "*Q1.5_1: My child plays alone*" would determine whether they prefer to play alone and if so, is this true for online games. Choices range between *always* (scored 4) to *never* (scored 0).

- **Playing OCG (frequency of OCG)**

This part has one questionnaire item (statement) that is treated and analysed as ordinal factors. This statement aims to score playing of OCG (frequency of playing OCG), where parents were asked to respond to the question (My child plays OCG, Q1.5_4). This question is designed as a frequency Likert scale where participants are given five choices ranging between *always* (scored 4) to *never* (scored 0). A higher score means a higher frequency of playing OCG. It is important to mention this score is only recorded for participants who have not played MC, because MC has a different frequency score, which is discussed below.

- **Lifetime duration of playing MC and MC frequency**

This part has two questionnaire items (statements) and questions that are treated and analysed separately as ordinal factors. Parents of children who have not played MC did not take this part, as it only includes statements about MC.

The first statement is scored separately between 1 and 5. The question was Q2.3, "*My child has been playing Minecraft for*", and choices ranged as follows - *1-5 months*, score 1 to *3 years or over*, scored as 5. In the result and discussion section of the thesis, two terms are used often to refer to this concept, lifetime duration of playing MC, e.g., 'greater number of months and years playing is…etc.' or 'higher number of months and years is…etc.'

The second statement is related to the incidence of playing MC in a week, which was Q 2.4 "*My child plays Minecraft in a week for*", and the choices ranged between *1-8 hours*, scored 1 to *33 hours or over*, scored 5. The term 'frequency of playing MC' or 'MC frequency' are used in the result and discussion section of the thesis to refer to this factor. A higher score means a higher frequency of playing MC. This score is only recorded for participants who have played MC.

- **Playing MC with others**

This part has one questionnaire item (statement) that is treated and analysed as an ordinal factor. This statement aims to score playing MC with others, where parents were asked to respond to the question *"does your child play Minecraft in a multiplayer mode,"* Q3.1. This question is designed as a frequency Likert scale where participants are given five choices ranged between *always* (scored 5) to *never* (scored 1). A higher score means a higher frequency of playing MC with others. Importantly, this score is only recorded for participants who have played MC with others.

- **Impact of MC on the children's life**

This part has five questionnaire items (statements) and questions that are treated and analysed separately as an ordinal outcome. It was designed using a semantic differential scale, a scale of two polar adjectives (extremely positive vs extremely negative) and aims to find whether playing MC has any impact on a different aspect of the children's life from their parents or guardians' perspectives. Each statement is scored separately between 1 and 5, where a higher score means extremely positive. The wording of this part was adapted from the SDQ. In the double-sided version of SDQ with impact supplement, parents were asked whether their child has some mental difficulties in these areas: emotions, peer relationships, friendships and classroom learning. I adopted the wording of these questions but added an item about the child's participation in society and community events. Importantly, I did not adopt the choices. Instead, I used five scales of extremely positive to extremely negative. In this thesis, only two-parts were reported, which are the impact of MC on

peer relationships and friendships skills (§ 9.5). Friendship scores may indicate a higher level of closeness than just a peer relationship: Berndt and McCandless (2009) argued that friendship is more than a relationship between two individuals because friendship involves caring for one another and respecting each other's principles. Berndt and McCandless (2009, p.63) define friendships as the "closest of children's relationships with peers" and stated that not all relationships could be labelled as friendships (this is discussed more in § 2.5). The main aims of this part are to uncover how parents see the impact, and how MC impacts the life of the child on other areas that are related to developing relationships, and so is necessary for the discussion.

5.3.3.2 Interview

The interview design was of a semi-structured design, and each interview lasted on average 09:54 minutes for children and 09:45 minutes for parents' interviews. In the interview, I was looking for information about how playing MC has an impact on children (Table 5.3). Because the interview was a semi-structured design, the interview questions may be slightly changed from one participant to another due to the flow of the interview.

Table 5.3: Interview questions

Section1: Parents or guardians' Interview
1. Why does your child play MC? What was his/her motivation?
2. Based on your thought, what does he/she want from MC? Is MC his/her favourite game, why?
3. What does your child do mostly in MC?
4. Do you know who plays with your child in the MC server? Could you describe their relationship with each other?
5. Has your child made any friends because of the game? How? Are they online or physical friends? Do they have autism or deafness?
6. Does he/she chat with other players? During or after the game? Is their conversation related to the game or something else?
7. Has he/she administered any server? Does he/she talk about his/her experience on that? What does he/she think?

8. Do you think the game helps your child to develop his/her relationship with his/her peers or family members? Players or non-players? How?
9. Do you think MC can be used for educational purposes? How?
10. Do you think MC has any impact on your child's academic achievement? How?
11. How do you maintain your child's safety?
12. Do you think MC has any limitations (things you do not like or your child does not like)?
13. Does your child understand your perspective of his/her gaming activity (with MC)?
14. Thank you for all that valuable information, is there anything else you would like to add before we end?

Section2: Children's Interview

1. What is MC? How long have you played MC?
2. Why do you play MC? What makes it a different game?
3. Do you have a friend who plays MC? Do you play together? Do you feel the game supports your relationship?
4. Do you play MC with your peers/friends? How many are they? In the same place (nearby) or at a distance (their physical bodies are not nearby)? Does your relationship with each other change due to playing together?
5. Do you play with your family members (e.g., brothers/sisters)? How many are they? Does your relationship with each other change due to playing together?
6. To what degree does MC help you to interact with others (such as friends, peers and family members)?
7. How do you feel after playing MC?
8. What do you like about MC? And what do you dislike about MC?
9. Do you think MC has any impact on your physical activities? Or your participation in school and community activities?
10. How do you perceive your parents' thoughts about the game?
11. Thank you for all that valuable information, is there any comment you would like to add before we end?

5.3.3.3 Observation

A disclosed structured observation was conducted to record and note the nature of playing by a different group, and whether this difference has an impact on the change of the relationship skills or mental health status. Observations enriched the data with

details that may help researchers to answer research questions with further evidence. An average of 27:00 minutes of observations was video recorded for each player in the four observation cases. The observation was designed to collect data about behaviours related to socialisation within the game, such as empathy, awareness of others, solidarity (collaborating), agreement, sharing something, remaining nearby others, responding to others' attempts to communicate, showing dominance (power)… etc. with a number of children who play MC together in a multiplayer mode; however, since there was only one observed participant who played in a multiplayer mode, the observation generated all the players' actions.

5.3.4 Study Development and Piloting

The questionnaire was the primary source for collecting data, and its development is presented here. In the first phase, I designed the initial version of the whole questionnaire based on the needed information. In the second phase, an expert in questionnaire design and quantitative methods was consulted on the MC questionnaire (section 3 of the whole questionnaire) and advised me regarding the language and simplicity as well as the questionnaire's ability to answer the research questions and to ensure its content validity. His advice was practical and was taken into consideration in another draft that was modified later. In the third phase, the questionnaire was given to PhD students, who have a child who plays MC, for their general feedback and comments on content validity. This had a powerful impact on the development of the questionnaire subsequently.

In the fourth stage, the questionnaire was submitted for the first annual review of the PhD, which helped in reducing and clarifying items, and introduced the idea of implementing part 5 of the questionnaire, which was about including the use of other games/game types to serve as controls for MC-specific effects. In the fifth stage, the questionnaires were submitted alongside the ethical application to the University Ethical Committee (UEC), and their feedback on the language clarity helped in the process. Throughout the process of developing the questionnaires, supervisors' feedback and suggestions were helpful in finalising the questionnaire design. In the

final stage, which was after ethical approval had been obtained, the questionnaires were piloted with a small sample of participants (*n*=7).

5.3.5 Validity and Reliability

Validity is the assurance that the study measures what we want to measure (Muijs, 2004). This study was designed using the Convergent Mixed Methods Design, where the researcher collects both quantitative and qualitative data together but analyses them separately, and then uses the results of one to confirm or disconfirm the other (Creswell & Creswell, 2018). The main theory of this approach is that quantitative and qualitative data afford different outcomes, and the historical idea is that a psychological trait can be understood better by gathering different forms of data (Creswell & Creswell, 2018). As mentioned earlier (§ 5.3), the aim of using this specific design is to contribute better to the research problem by converging (or triangulating) quantitative data and discuss it with in-depth qualitative data (Creswell & Creswell, 2018), and overcome the weaknesses of quantitative and qualitative research (Caruth, 2013), which should increase the research finding's validity (Creswell & Clark, 2017; Johnson & Onwuegbuzie, 2004).

As mentioned in § 5.3.4, the MC questionnaire was validated through the face and content validity, taking the threat to internal and external validity into consideration. The main idea of internal validity is the assurance that the observed changes are the effect of independent variables, not extraneous variables (Mertens & McLaughlin, 2004). In this study, the goal is to look for associations and predictions; no causation relationship is assumed or claimed. Children's history of playing and experiences of what they have confronted during play can impact how their parents' responded to the game, but this is one of the objectives of the questionnaires (Part 4). The study also takes into consideration the age, gender, educational placements of the child and the severity of the disability to control for possible maturation threat to internal validity. There was a concern that the selection criteria for the sample were identical for all groups, but some children with ASD or HL may not be similar to TD of the same age and gender due to the functional disturbance of the disability affecting social

interaction, learning, and communication abilities. This is one of the concerns with all research with children with special needs that is almost impossible to control for as they are very heterogeneous (Mertens & McLaughlin, 2004).

Reliability is the indication of the scale accuracy (Muijs, 2004). One of the most common measurements for reliability in questionnaires is Cronbach's coefficient alpha for the internal consistency, which is "equivalent to the average of all possible split-half reliability value that could be calculated on the data set" (Coolican, 2014, p.217). The coefficient alpha will be lower if the questionnaire has more separated and unrelated factors. Cronbach's alpha ranges from 0 to 1; a value around .75 is considered as adequately reliable (Coolican, 2014).

Cronbach's alpha was used to test the reliability of the developed questionnaire (MC questionnaire), and it was considered to be sufficiently reliable. Cronbach's Alpha is used to provide a measure of the internal consistency and describes whether all the items in the test measure the same concept or construct; therefore, whether they are connected to the inter-relatedness of the items within the questionnaire (Tavakol & Dennick, 2011). The Cronbach's alpha result for the created part of the questionnaires (Section 3), which comprised 37 items across the whole sample was (α = .948), in the UK sample was (α = .940), and in the KSA sample was (α = .949).

5.3.6 Translation Procedures

In the first stage, the questionnaires, Participation Information Sheet (PIS) and consent forms were translated using forward translation (to Arabic) and then backwards translation (to English); then the backwards translation was compared with the original. The order of questions was identical for both languages. In the second stage and after translating the questionnaire into Arabic, it was given to two friends, one who has a master's from the US in teaching children with ASD, and another who is studying for a statistics PhD in the UK, for checking the translation accuracy, and their comments were implemented. In the third phase, I (as a native Arabic speaker) checked it and asked another person to check the Arabic version linguistically (regarding Arabic grammar and linguistic structure).

In the fourth stage, two people were asked to rate the two versions (the original and the backwards translation). Cohen's kappa (κ), which is a measure of inter-rater agreement, was run to determine if there was an agreement between the two raters on the forward and backwards versions. There was substantial agreement between the two raters' judgements, $\kappa = .779$, $p < .001$. In the last phase, someone who speaks both languages and has a child who played MC was asked to take the English version and then, after a month had lapsed, the Arabic version to minimize the learning effect. Cohen's kappa (κ) was run to determine if there was an agreement between the two versions of the similarity between the Arabic and English translation. There was substantial agreement between the two versions, $\kappa = .786$, $p < .001$.

5.4 Data Collection

This project has two components: quantitative data collected through a one-time online questionnaire filled in by parents, and qualitative data collected through observing and interviewing children and their parents that was conducted in the children's parents' place of choice. The questionnaire was available for eight months from the date this investigation was advertised (starting in May 2017 till the end of September 2017), and then from 20th December 2017 till 31st March 2018, for all three groups (parents of children with ASD; parents of children with HL; and parents of children without disabilities) from the UK and the KSA.

Participants were recruited from the UK and KSA through either: 1) advertisements placed in social media and disabilities organisations' social and web-based media; or 2) through direct recruitment of individuals with ASD or HL using the organisations' databases of individuals suitable for the study. In this case, individuals in these organisations' databases could not be contacted by the researcher directly; instead, the database teams identified families who met this study's criteria and contacted them on the researcher's behalf. The organisations' team posted or emailed the study information to the families. The families who were interested in taking part then completed the questionnaire. In some cases, the researcher was contacted by parents directly, asking to take part in the study, and then the study advert with the

questionnaire link was sent to them. Participants from the UK and KSA were recruited through many organisations (e. g., National Children's Bureau, DisabledGo, Access Bedford, British Psychological Society, Nottinghamshire Deaf Society, Scottish Council on Deafness, Royal Association of Deaf People, Autism Research Centre at the University of Cambridge, Research Autism, Autism Speaks, Scottish Autism, Disability Sport, and Jeddah Institution for Speech and Hearing).

To summarize, as previously mentioned, the data collection and analysis was conducted by triangulation design to validate the research outcomes using both quantitative and qualitative data. The quantitative data were analysed first. After that, qualitative data was used to support, validate and explain the quantitative data. All data, quantitative and qualitative, is discussed in the same order as the investigation questions. In consideration of the foregoing, all data were collected concurrently, but the emphasis was given to quantitative data.

5.5 Data Analysis

This section presented the procedures used for analysing both quantitative and qualitative data. As mentioned earlier, the quantitative methodology was the primary method of data collection, and data analysis as the researcher used the Convergent Mixed Methods Design for this research, where the data is analysed separately, and then the results of one used to confirm or disconfirm the other (Creswell et al., 2003; Creswell & Creswell, 2018). The connecting point between data exists at the level of discussion and conclusions when the results of different data types are compared for convergence. Therefore, each data set remained analytically separate.

5.5.1 Quantitative data

Quantitative data were obtained from self-administered questionnaires, and the responses were analysed and reported using the Statistical Package for the Social Sciences (SPSS) (v.24) software and the embedded report tool from Qualtrics. Also, all statistical analyses were two-tailed at a significance level of (0.05) for all statistical tests to consider their significance. The term “countries” is used to represent the

United Kingdom (UK) and Kingdom of Saudi Arabia (KSA). The term “condition” is used for the diagnosed condition, which means the defined disability (suspected ASD, the official diagnosis of ASD, HL and TD). Suspected ASD and official diagnosis of ASD are combined later on under “ASD” because there was no significant difference between the two groups. The term “groups” is used to represent the playgroup: has not played an online computer game (OCG) before, has played OCG, Minecraft (MC) in a single-player mode, and MC in Multiplayer mode. This differentiation was used to facilitate and ease the description and presentation of the data.

The analysis of the quantitative data involves organising and summarising the mass of data collected. In the survey, data contained 304 responses in total from both countries; however, only 255 responses were included in the data analysis due to a large number of missing responses or not meeting the study criteria (the process of cleaning and preparing data is presented in § 6.2). In the quantitative part, data were obtained using a set of questions and statements, and this involved closed questions (numeric value) and open-ended questions (statements).

Firstly, the data was downloaded from Qualtrics.com to Excel Spreadsheet using numeric values and anonymised the data into the spreadsheet by deleting the qualitative data, section 5 (Further investigations questions), and personal information, such as name, emails, contact details and postcode.

Secondly, the country was coded (1=UK; 2= KSA) as it is not coded through Qualtrics. After that, the conditions also was coded (1= ASD; 2= HL; TD=3). Conditions were done through the following orders:

a) Looking at the AQ-10 outcomes (if the participants scored above 6; then it was coded as ‘suspected ASD’, coded as 10);
b) Looking at question 6.8 - Has your child been diagnosed with ASD or HL;
    i. If the child has been diagnosed with ASD (coded as ‘officially diagnosed with ASD’, coded as 11);
    ii. If the child has been diagnosed with HL (coded: HL, coded as 2);
c) If all the above is not true, then the child was coded as a TD (coded as 3).

Note that officially diagnosed with ASD and suspected ASD were combined later under ASD (coded as 1), because there was no significant difference between the two groups (full description of this combination process is presented at § 6.5).

Thirdly, data then was transferred to SPSS. The total score of AQ-10 and SDQ was already counted in Qualtrics.com, and I calculated the total scores of each one of my variables using the SPSS option of computing variables. Overall, SPSS was mainly used to store and analyse the data. The analysis process began after the data was cleaned (as described in § 6.2).

It is important within quantitative research to ensure that data is normally distributed to the entire population. Commonly used methods are Skewness which accepts a score of 0 only to show normal distribution and a score of less than -2 or greater than 2 shows that the distribution is highly skewed, or kurtosis which accepts a score between -2 and +2 to account for a normal distribution (George & Mallery, 2010). However, the Shapiro Wilk which considers both the Skewness and kurtosis scores simultaneously and tests normality by comparing the data collected with a normal distribution is a popular method used (Yap & Sim, 2011). The Shapiro Wilk is considered a powerful and widely accepted method in ensuring the normality of distribution within a data set (Seier, 2011; Thode, 2002) and as it is also appropriate to use for small sample sizes (Gissane, 2016); it was therefore considered suitable for the current data analyses. The Shapiro Wilk states that if the p-value is less than or equal to 0.05, then the data is not evenly distributed. Therefore, as can be seen from Table 5.4, only the data of the total difficulties scores appear to be normally distributed within the KSA sample.

Outliers of both mild and extreme scores can be problematic in achieving accurate analyses of a data set. Therefore, these should be checked for and removed if found, as outliers affect the mean scores, causing errors within the analysis. According to Birkett (2017, para. 19), the “extreme outliers tend to lie more than 3.0 times the interquartile range below the first quartile or above the third quartile, and mild outliers lie between 1.5 times and 3.0 times the interquartile range below the first quartile or above the third quartile”. Scatterplots and boxplots are commonly used

graphs as they clearly show the presence of any outliers. This study used boxplots of all dependent variables (e.g., total difficulties score, emotional symptoms, conduct problems, hyperactivity/inattention and peer relationship problems) and found one mild outlier, a score of 39 in the total difficulties score in the KSA sample, which was removed due to the previously mentioned reason. When data were reanalysed, no outliers were found. As data was not found to be evenly distributed, this analysis adopted the non-parametric test to account for this.

Table 5.4: Descriptive statistics and tests of Normality

		N	Min.	Max.	Mean	Std. Dev.	Skewness	Kurtosis	Shapiro-Wilk	
									Statistic	Sig.
ASD	UK	131	1	10	5.76	3.012	-0.055	-1.338	.917	.000
	KSA	124	0	10	5.35	2.663	-0.438	-0.81	.938	.000
Total difficulties	UK	131	0	34	17.6	8.252	-0.245	-0.567	.974	.014
	KSA	124	0	39	18.43	6.994	-0.24	0.061	.984	**.152**
Emotional symptoms	UK	131	0	10	4.35	3.01	0.283	-1.085	.937	.000
	KSA	124	0	10	4.31	2.604	0.134	-0.884	.958	.001
Conduct problems	UK	131	0	9	3.16	2.424	0.616	-0.21	.930	.000
	KSA	124	0	10	4.04	2.177	0.073	-0.315	.968	.005
Hyperactivity inattention	UK	131	0	10	5.89	2.766	-0.328	-0.74	.951	.000
	KSA	124	0	10	5.31	2.379	-0.243	-0.755	.963	.002
Peer relationship problems	UK	131	0	10	4.2	2.867	0.125	-0.948	.948	.000
	KSA	124	0	9	4.77	2.319	-0.289	-0.841	.952	.000
Prosocial behaviour	UK	131	0	10	5.6	2.654	-0.082	-0.753	.962	.001
	KSA	124	0	10	5.1	2.619	0.049	-0.849	.966	.003
Child's Age	UK	131	8	14	10.1	1.889	0.641	-0.661	.886	.000

	KSA	124	8	14	9.88	1.819	0.759	-0.332	.865	.000
Preference for playing alone	UK	131	0	4	2.41	0.902	-0.021	-0.494	.890	.000
	KSA	124	0	4	2.36	0.982	0.051	-0.373	.891	.000
Frequency of playing OCG	UK	131	0	4	2.75	1.105	-0.77	0.087	.864	.000
	KSA	124	0	4	2.43	1.326	-0.425	-0.958	.882	.000
MC lifetime duration	UK	131	0	5	3.05	1.862	-0.602	-1.125	.829	.000
	KSA	124	0	5	1.98	2.048	0.293	-1.645	.781	.000
MC frequency	UK	131	0	5	1.18	1.034	1.167	2.014	.839	.000
	KSA	124	0	5	0.79	1.092	1.762	2.973	.715	.000
Playing MC with others	UK	131	0	5	2.24	1.509	-0.043	-1.059	.913	.000
	KSA	124	0	5	1.31	1.45	0.864	-0.384	.827	.000

The analysing process for the quantitative data involved statistical methods, and the results are presented in tables and figures. The research hypotheses were analysed using different analysis techniques, which depended on the nature of the hypothesis and the type of related data. Univariate descriptive statistical analysis (i.e. frequency, percentage, mean, standard deviation) was used occasionally, as needed. After that, the bivariate descriptive analysis was used to provide more advanced analysis and to confirm or disconfirm the hypotheses by explaining to what extent independent variables are associated with the dependent variable.

To find differences among groups, four types of tests were used. First, chi-square tests were run for the playing group versus the conditions because the data are categorical (Chapter 7). Secondly, the Kruskal Wallis test is a nonparametric test that permits a comparison of multiple independent samples. It is performed to test for significant differences of ID variables across dependent variables (e.g., SDQ scores, AQ-10 ...etc.). Since most of the data obtained did not meet criteria for parametric analysis, the Kruskal–Wallis analysis of variance was performed to estimate the overall significance of differences between groups multiple times. Thirdly, the Mann-

Whitney U test is a non-parametric test that was used multiple times to compare the means of two unpaired samples because data is ordinal. Finally, One-way ANOVA was used once to find the differences between the means of the total difficulties score across the playing groups because the total difficulties score is normally distributed (Chapter 8). To test the correlation coefficient between the factors and outcomes, Spearman rank correlation is used because the variables are not normally distributed and the relationship between the variables was not linear, except for the total difficulties scores for the KSA sample only, where Pearson correlation was used because the data is normally distributed.

Finally, the multivariate analysis was used to advance these bivariate analysis findings using multiple regression procedures, which is an extension of simple linear regression. Multiple regressions were used to predict the value of an outcome (DV) based on the value of multiple other variables (predictors' variables). However, as set out in Chapter 7, Multinomial logistic regression was performed to assess the presence of a relationship between the dependent variable (Playing group) and a combination of independent variables (Country, Conditions, Gender and Age), because the dependent variable is a categorical variable. The use of correlation and regression is set out in Chapters eight and nine because correlation described the association or the absence of the relationship between two variables that move together, whereas regression analysis predicted the value of the dependent variable (outcomes) based on the known value of the independent variable (factors). Furthermore, correlation tests are used to indicate the strength of association between variables, whereas regression reflects the impact of the independent variables on the dependent variable. Further data analysing procedures is presented at the beginning of each related result chapter. Findings from the quantitative data are further supplemented by the qualitative data in Chapter 10 and 11.

5.5.2 Qualitative data

The interviews and observation were conducted alongside the survey study for the purpose of supplementing the survey findings. As usual, the qualitative study tends

to focus on the quality of something rather than its quantity, and meaning of the phenomenon and action. Qualitative methodologists provide multiple frameworks for making qualitative data analyses more explicit (Bryman, 2016; Creswell & Creswell, 2018), so that the analysis process of the qualitative studies promote explicit findings with openness and reduce bias (Anfara, Brown & Mangione, 2002).

In this study, thematic analysis was used to analyse all the qualitative data, with the aim of thematic analysis being to search for themes (Bryman, 2016). With interviews, the thematic analysis enables better exploration of interviewee statements as well as matching them with the parents' statements under an assigned theme or a sub-theme. It also helped me, as a researcher, to understand how players make sense of gaming behaviours by engaging in an interpretative aspect. The initial step in analysing the interviews is to keep notes on related actions during the observation. All the interviewees were observed before the interview, which allowed me to ask questions about what they did and why in the observation session. The interview was conducted in Arabic because all interviewees do not speak English.

Secondly, the qualitative data was transformed and transcribed from the audio recording into a soft copy written form. In complying with the guidelines of qualitative data (Bryman, 2016; Creswell & Creswell, 2018), each word spoken by the participant or the researcher was transcribed. However, the length of pauses or non-verbal expressions was not transcribed as they are not relevant to the design of this interview. Seven interviews, in total, were conducted and thus the transcriptions were separated into seven cases. To ensure that the interview was transcribed correctly and appropriately, each transcription was read again while listening to the original audio recording after a month had elapsed from the original transcriptions to validate the transcriptions.

Thirdly, transcriptions were then clustered into one of the important themes through cases in a new file; though, each transcription was still separated from each case. In this regard, there were eight essential themes discussed, Including: 'Children's perspective', 'Education and learning', 'Parents' perspective', 'Parents' recommendation', 'What children do in the MC', 'Communication with others/

parents', 'Playing with others', and 'Concern'. Themes were not presented alone as the design of this project is the Convergent Mixed Methods Design, where the qualitative data is used to confirm or disconfirm the quantitative data (§ 5.3). The analytical process started with an in-conjunction narrative examination of each case observation; thus, each case has a report of the child's interview, the parents' interview, and the observation; then the data is used to support the quantitative data, where it is relative. However, all the seven semi-structured interviews were clustered into one of the important themes manually, without using a software for analysis for several reasons, including that software cannot understand the nuances of meaning of a text; the number of interviews is seven, which does not provide a massive set of differences; every two interviews are related, i.e., a child and his/her parent; the interviews design was semi-structured (which means that important themes are already identifiable through the interview questions); and mainly because the researcher was not able to find a software that can be used with the Arabic transcripts. Although this process may seem to be time-consuming as it gathers data from three sources to support a quantitative claim, it produced a comprehensive set of evidence on the quantitative data outcomes.

Template analysis is one type of thematic analysis that is widely used in qualitative psychology research, but with the main feature being that main themes are made and used and identified by the researcher in advance (Brooks, McCluskey, Turley & King, 2015). According to Brooks et al. (2015, p.203), "it encourages the analyst to develop themes more extensively where the richest data (in relation to the research question) are found". Using a priori themes might be "advantageous in qualitative psychology research with particular applied concerns which need to be incorporated into the analysis" (Brooks et al., 2015, p.218), which is important to address practical aspects or concerns that are related to the research project, and is a useful approach because this research used convergent mixed methods design, with the emphasis on the quantitative data and using the qualitative data to confirm or disconfirm the outcomes of the quantitative analysis. King (2004) argues that template analysis is referred to as multiple and related techniques for thematically organising and

analysing codes. Furthermore, according to King (2004, p.257) another advantage of using this type of analysis that it "works particularly well when the aim is to compare the perspectives of different groups of staff within a specific context".

It also should be noted that although themes presented in §10.2, §10.3 and §10.4 were developed in advance, based on this investigation's research questions, they were the main identified themes on the parental statements, as Miller and Crabtree (1999, p.167) stated, "researchers can develop codes only after some initial exploration of the data has taken place, using an immersion/ crystallisation or editing organising style. A common intermediate approach is when some initial codes are refined and modified during the analysis process." However, similar to other approaches, template analysis has a limitation that the focus is typically on an across-case instead of within-case analysis, which may result in inevitably some loss of the individual accounts. To reduce selection biases, all the raw statements and the details of each case are provided in Appendix 4, §A. Furthermore, the method of analysis used for this study supports the grouping of direct quotations under each theme; thus, direct quotations of the raw statements are used as much as possible in reporting results, as advised by King (2004), to give a sense of the original text and to provide a better understanding of how individuals construct their notions of the game.

There are two ways to undertake thematic analysis, which are inductive and deductive approaches (Braun & Clarke, 2006, p.83). For this part, the deductive approach is used for three main reasons. First, this research design is Convergent Mixed Methods Design (§5.3), where the qualitative data is used to confirm or disconfirm the quantitative data. Secondly, the interview design was semi-structured (§5.3.3.2) to concentrate on the topics and be more focussed, so questions are prepared mostly before the interview is conducted. Third, the children and parents' interviews are highly related (questions mentioned in Table 5.3), so themes are almost the same across the interviews. Therefore, the deductive approach is used, where analysis is mainly focused on the interview's questions, which cover four main areas, i.e., reasons for playing MC (§10.7.1; interview questions 1 & 2), playing with

others and relationship (§10.7.2; interview questions 3,4,5,6,7 & 8), academic aspect (§**Error! Reference source not found.**; interview questions 9 & 10), and concerns (§**Error! Reference source not found.**; interview questions 11 & 12). All interview questions are mentioned in Table 5.3.

5.6 Ethical Considerations of the Research

Ethical approval was obtained from the University of Strathclyde Ethics Committee because this investigation had met their criteria, which is "*Participants who may be unable to consent for themselves or have significant learning difficulties"*. The ethical issues of this investigation have been addressed according to the Economic and Social Research Council (ESRC) (2016), British Educational Research Association (BERA) (2011), and the British Psychological Society (2010) research ethics principles, as well as the Code of Practice on Investigations Involving Human Beings (Seventh Edition) of the University of Strathclyde (RKES, 2015). This research took into consideration the need for autonomy, where participants have been informed about everything they wanted to know about the research, and they had the right to participate in the study based on their will as well as they were free to withdraw at any time without providing a reason. The beneficence of the research has also been studied since the beginning of October 2015, and there is no identifiable possibility of a risk to harm the physical or mental health of the participants, while it has beneficial effects on the educational and psychological fields of ASD and HL. Moreover, this research is doing no harm, and all possible harm has been avoided in the designing and collecting processes. This investigation also takes the confidentiality of data with prioritised consideration, with all data being kept safely and securely. Confidentiality and privacy of participants are our top principles. Besides, this study maintains the integrity of all the research process, including any potential conflicts of interest. Data is reported with a full degree of transparency and openness.

5.6.1 Informed Consent

Through the study advert, parents or guardians were invited to participate in the questionnaire. For those who agreed, they were given the Participation Information Sheet, and then the consent form through Qualtrics questionnaires (part 1). At the end of the questionnaires, they were asked if they and their children were willing to take part in the interviews and observations (part 2). Once they agreed to take part, they were contacted later for the planning of the observation and the interview and given the Participation Information Sheet, and then the consent form.

This investigation recognizes the importance of taking Article 12 of the United Nations Convention on the Rights of the Child in high consideration, where all interviewed children have been "granted the right to express their views freely in all matters affecting them, commensurate with their age and maturity" (BERA, 2011, p.6). This study was explained clearly, and participants were asked to request clarification if needed. Although the main consent form was signed by parents on behalf of their children in accordance with Guidelines for educational research by BERA (2011), parents were requested to ask their children for verbal consent to verify that the children's participation was also voluntary. Thus, there was no imbalanced relationship between researchers and participants, and there were no deceptions either by neither the researchers nor the participants as the research was explained openly and honestly, and as the participation was voluntary.

5.6.2 Confidentiality and Anonymity

Confidentiality about all participants' identifiable information was maintained throughout the study according to section 4.4 of the Code of Practice on Investigations Involving Human Beings (Seventh Edition) of the University of Strathclyde (RKES, 2015, p.20). The demographic information was placed at the end of the survey, so participants who did not conclude the questionnaire or chose to withdraw cannot be identified, and all their participation information was deleted. Personal details, such as name and contact information were optional and was anonymised before data analysis. All data were kept secure in the University hard-

drive (H) and backed up in StrathCloud. Printed papers, where they were needed, were held in a safe locker at the Lord Hope Building. The locker was obtained from the Graduate School office, and then they were shredded. Thus, participants' confidentiality of all identifiable information was sustained throughout the study.

5.6.3 Harm

No injury or harm was expected with this investigation. Participants filled in the survey wherever they wanted. Regarding the observation and the interview, the researcher made sure that there was a minimal chance that participants may experience distress or discomfort in the chosen place, and in ensuring that the research has minimal possibility to cause emotional or other harm according to the guidelines for educational research by the BERA (2011). Overall, there was no identified personal and social harm to participants. Participants' dignity and safety were prioritised. They were not asked any sensitive question or a question that might cause misunderstandings or make them feel insulted. They had the right to refuse to answer any question. Regarding parents' choices for the meeting for the interviews and observations, the researcher ensured that the selected place was safe. The researcher had completed the Scotland Mental Health First Aid course before data collection had started, in case any mental health issue appeared. A General risk assessment form (S20) was used to maintain health and safety arrangements. The questionnaire was concluded by asking participants whether they were willing to take part in a further study. If they decided to do so, they were invited to provide their details. The second part, the observation and interview, were ended by asking whether the interviewee had any other comments. The main reason for this question was to ensure the interview was ended smoothly and not unexpectedly.

5.6.4 Cultural Sensitivity

The researcher recognised possible cultural issues in undertaking research with a specific society, such as pursuing research with children with special needs. For example, in most developing countries, such as Saudi Arabia, it is challenging to carry out research on children with disabilities for a number of reasons. These reasons may

vary from place to place and from culture to culture, but they may include families failing or refusing to recognise their child's disability, feeling guilty or ashamed for having a child with special needs (Alnemary, 2017; Al-Gain & Al-Abdulwahab, 2002; Hadidi & Al Khateeb, 2015), or not being able to have access to the right information and services, such as diagnosis and support (Aldabas, 2015; Al-Jadid, 2013; Alnemary et al., 2017; Alshehri, 2018; Daghustani, 2017; Hadidi & Al Khateeb, 2015). Mashat, Wald and Parsons (2014, p.428) also reported that finding the right participants with ASD in KSA was challenging, as "it is difficult to reach adults with HFA or Asperger's syndrome in Arab countries. This could be because they may be hidden, not diagnosed or do not admit to having the disability."

In addition, although the rights of children with special needs have been granted by the law (Alquraini, 2010; Hadidi & Al Khateeb, 2015; Organisation of Islamic Cooperation, 2005), a misunderstanding of their rights and needs is still a key concern in the country. According to Islam, which is the official religion of the country, which is ruled according to the Quran's teachings and based on Islamic religious law, all people have various rights, including the right of life, individual freedom, education, family structure and social life being protected from all forms of physical or psychological abuse (Organisation of Islamic Cooperation, 2005). This includes the rights of children with disabilities to be integrated into society, as well as being treated equally to others (Organisation of Islamic Cooperation, 2005). However, cultural factors, such as feeling guilty or ashamed still seem to be dominating.

Undertaking cross-cultural studies have some limitation that is recognised. Necib (2017) presented some of the challenges in undertaking data collection using semi-structured interviews with Algerian PhD students based in the UK. He concluded that these challenges varied widely and included collaborating with international researchers who were from outside the country, where some individuals may have considered them as "spies" or "Western interlopers", especially when it comes to issues that may be considered as culturally sensitive.

Furthermore, using the observations and interviews from a sensitive sample has been criticised in that the data would be less anonymised (Gray, 2014) and, therefore, it

might be less desirable to participants (Bailey, 1994). This was an issue which occurred in the process of Alzahrani's data collection for his thesis titled *An Evaluation of the Questions in the Mathematics Textbooks of Saudi Arabian Secondary Schools*, published by the School of Education, the University of Strathclyde, in 2014, and available at Strathclyde library. Furthermore, as Larsson (2016) indicated, one of the main problems in finding participants with ASD or HL is that the use of photographs in research of an Arab/Muslim context is prohibited due to some religious reasons, especially when it affects girls or women.

5.6.5 Incentive

The research offered the chance of winning an iPad mini 4 Wi-Fi 128GB (price £299.00) as an incentive for a randomly selected participant in this study, with their name being pulled out randomly using the list of all the participants who completed the questionnaire. In this investigation, we followed all ethical aspects mentioned by Cobanoglu and Cobanoglu (2003). This incentive does not infringe or dissent the ethical consideration stated by the Guidelines for educational research by the BERA (2011) and The Research Ethics Guidebook (n.d.), because our incentive had no undesirable effects on health, and there is no possible creation of bias in the sampling or participant responses. Participants were eligible for our incentives regardless of their responses or their diagnosis, which was clearly stated in the study advert. The iPad mini would seem to have no adverse impact on the participants, as they were already adults, and it is not very expensive compared to other types of possible incentives, such as iPad (not mini).

Everyone who took any part in this study and provided their contact details in section 4 of the questionnaire was included in the incentive pull regardless of: whether they were in the interview and observation (part 2), whether they had completed the questionnaire, and regardless of participants' location. Thus, the incentive winner was pulled out randomly using the list of participants from a list in Excel of all participants from both countries (the UK and KSA). This process was undertaken within six months of closing the survey and in the presence of the chief investigator.

There were seven reasons for using the incentive in this research, with the aim to increase the response rate. The first reason is that the incentive encourages participants to participate in the study given that questionnaires are not the easiest way to engage informants. Second, the questionnaire might take up to 15 minutes of the parents' time, which is high especially for parents with children with special needs as these disabilities require more of their time; thus, a motivator was needed. Third, the researcher had a limited time to collect data, for financial and legal reasons, due to the scholarship and visa expiration, so including an incentive might increase the chance of having enough participants in the decided time. Fourth, because I expected a high number of participants in the questionnaire, we cannot financially offer incentives for all of them, so it would be helpful to have something that anyone can win. Fifth, some people may not value participating in research due to misunderstanding the importance of research, especially in the developing country, KSA, so providing something may encourage them to participate. Last but not least, the more participation we have, the more the results would be reliable.

5.6.6 Data Collection, Storage and Security

The raw data is anonymised and given a code name, with the key for code names being stored in a separate location from the raw data (Pseudo-anonymised). The original data was locked and protected using a fixed password within the University hard drive and backed up in Strathcloud. This was to enable the data to be gone back to, if necessary. The data will be stored for five years after the completion of this study, on the University of Strathclyde servers. In the questionnaires, participants were given the option not to include any identifiable personal data. All identifiable personal data were deleted before the analysing process. Thus, all data of all participants in this project were entirely anonymous (coded). For the observation and interview, all consent forms and the video and audio recording will be destroyed and deleted after the completion of this degree.

Overall, this research has sought to maximize the benefit of the researched tool for individuals and society with the aim of minimizing the possible risk and harm, which

is one of the ESRC (2016) and British Psychological Society (2010) research ethics principles as well as of the Code of Practice on Investigations Involving Human Beings (RKES, 2015). The researcher prioritised and respected the rights and dignity of these vulnerable individuals and groups. Thus, participation was voluntary, and participants were informed about the research aims and objectives appropriately with full integrity and transparency.

5.7 Chapter Conclusion

This chapter has described the research methodology used to conduct this study. It presented and justified the chosen research philosophy and paradigm. Pragmatism is the best paradigm for this study, and reasons were presented in §5.2. The research design is a correlation study because the primary aim of this research was to find a prediction or associations between playing MC and social-emotional and behavioural outcomes (§5.3). The convergent mixed methods design was used for this research and, the mixed method research design is selected due to its advantages in reducing the limitations and restrictions of quantitative and qualitative research approaches. The data collection took place in two locations: the United Kingdom (UK) and the Kingdom of Saudi Arabia (KSA). The data collection comprises four methodological research tools: a questionnaire for parents, interviews for parents, interviews for children, and observation (§5.3). An explanation of the procedures used to collect and analyse the data was also presented (§5.4 and §5.5). Finally, the chapter identified ethical considerations for the research (§5.6) and the Ethical approval was obtained from the University of Strathclyde Ethics Committee.

CHAPTER 6: SAMPLE CHARACTERISTICS

6.1 Introduction

This chapter presents the findings from the online questionnaires that are related to the demographic details of respondents at the outset. The questionnaire mainly included Likert-type and open-ended questions and presented and discussed in the methodology chapter (§5.3.3.1). The findings are discussed in relation to the research questions that lead the study. Data were analysed to identify, describe and explore the relationship between OCG (mainly MC) and mental health, which includes the relationship skills of children with ASD or HL as well as TD children. This chapter focuses on presenting the data gathered from the questionnaires in a meaningful way in order to facilitate the discussion. This chapter provides details of respondents at the outset. Tables and diagrams are used to clarify the presentation of the data.

6.2 Data Preparation and Cleaning

As stated in § 5.4, the survey for the first data collection round was available for five months, from 1 May 2017 to the end of September 2017. There were 99 responses from UK and 96 responses from KSA. Unfortunately, the conditions groups were unbalanced, and a second data collection round was needed to match the participants' groups as closely as possible. A second data collection round began on 20 December 2017 and ended on 31 March 2018, attracting 50 responses from the UK and 59 responses from the KSA. In total, the number of submitted responses was 149 from the UK and 155 from the KSA (304 overall). Out of the 304 responses, 88.81% (270 responses) completed all the questions, while the rest of the respondents exited the survey halfway. Initially, the submission rate of the survey from the UK was 94.63% (141 responses) and from the KSA was 83.22% (129 responses).

The process of cleaning and preparing data involves these next points:

1. Include only children aged between 8 and 14 years old. It is hard to assume that a person who is 15 would still be in primary school unless the child has a cognitive function problem or a severe learning disability. Thus, children under 8 or over 14 years old have been excluded (n= 7).
2. Include only children from the UK in the UK sample, and only children from the KSA in the KSA sample. For example, I excluded participants from the US and from the Gulf countries who filled in the survey (n= 8).
3. Delete all uncompleted questionnaires (n= 34) for the following reasons: A) due to missing core data, such as conditions, groups, gender, and age, and B) if the demographic information was placed at the end, so we cannot know whether respondents with an incomplete questionnaire decided to withdraw. Thus, for ethical purposes, incomplete data were dismissed.

As mentioned earlier, data were collected through two data collection rounds. Three changes were made in the 2nd data collection which resulted in increasing the number of participants, from the TD group mainly. First, recruiting for HL participants by going physically to the deaf schools with hard copies of questionnaires to try to increase HL group numbers and engage with teachers in KSA to increase numbers. Secondly, engaging again with the online questionnaire and online advertising to increase numbers, especially for the TD groups. Thirdly, the word 'autism' was deleted from the question title in the second round of data collection and removed from the hard copy that was sent to schools, so the title of the questionnaire became AQ-10 Child Version, instead of the title: Autism Spectrum Quotient (AQ-10 Child Version). Table 6.1 summarises the number of participants for each round of the questionnaire.

Table 6.1: Number of participants on the 1st data collection and the 2nd data collection rounds

Country		Data collection period		Total
		1st round	2nd round	
UK	ASD	60	2	62
	DHH	3	3	6
	TD	18	45	63
	Total	81	50	131
KSA	ASD	35	24	59
	DHH	2	3	5
	TD	28	32	60
	Total	65	59	124

6.3 Survey Completion

After the cleaning process, the completion rate of the cleaned data (Table 6.2) from the UK was 87.92% (131 responses), and from the KSA was 80% (124 responses). Furthermore, the average time spent filling the questionnaire from the UK was 16.51 minutes. This does not include 7 possible outliers in this calculation (in the average time), which was over 50 minutes. Average time spent filling the questionnaire from the KSA was 16.58 minutes. Two outliers (over 50 minutes) were not included in this calculation. Qualtrics allows respondents to carry on filling in the questionnaire later on and calculates the duration time based on the time the questionnaire was opened, so it would continue counting even if the respondent was not filling in the survey page. Therefore, outliers are not included in the following table.

Table 6.2: Descriptive statistics of questionnaire duration[a]

Country		N	Min	Max	Mean	*SD*
UK	Duration	124	1.83	49.86	16.51	9.64
KSA	Duration	122	2.05	44.56	16.58	10.08

[a]. The number is in minutes.

In order to try to minimise the number of variables I have in this project, I tested for the difference in the AQ-10 and SDQ scores between the two countries using Mann-Whitney. The results show that there was a statistical and significant difference in the SDQ outcomes between the two countries (p<.01). Also, the differences between the types of playing were tested using a Chi-square test (Table 7.1) and show statistically significant differences between the two countries (p<.01). Thus, each country is analysed separately, mainly because the cultural differences between the countries may produce different outcomes.

6.4 Gender & Age

Children in this sample are between the ages of 8 and 14 years, with a mean of 10.10 *SD*= 1.889 in the UK sample, and a mean of 9.88, SD= 1.819 in the KSA sample. A Mann-Whitney test indicated that age was not significantly different between the UK (Mdn = 10) and the KSA (Mdn = 10), U = 7574.00, p= .34. Participants whose children are less than 8 or over 14 years old are excluded because they did not meet this study's design criterion.

Table 6.3: Children's age

Country:	**UK**		**KSA**	
Age	**F**	**%**	**F**	**%**
8	34	26.0	41	33.1
9	26	19.8	15	12.1
10	23	17.6	30	24.2
11	18	13.7	17	13.7
12	11	8.4	5	4.0
13	9	6.9	9	7.3
14	10	7.6	7	5.6
Total	131	100	124	100

F: Frequency

Table 6.4 expresses the gender of the participants. The gender split of the children is not equal, with 78.6% were boys, and 21.4% were girls from the UK. In the KSA sample, 82.3% were boys, and 17.7% were girls. This implies that there is a higher number of boys than girls in the samples from both countries (see §7.8.3).

Table 6.4: Children's gender

Country	UK		KSA	
	F	%	F	%
Male	103	78.6	102	82.3
Female	28	21.4	22	17.7
Total	131	100	124	100

F: Frequency

6.5 Conditions

This study includes three main groups with diagnosed conditions: children with Autism Spectrum Disorder (ASD), Hearing Loss (HL), and Typically Developing children (TD). Although the survey was completed by the parents, the conditions of their child were a prioritised aspect of this investigation. Some children had already been diagnosed with ASD, and some children were suspected to have ASD without official diagnoses, especially in the KSA where the diagnosis is not available in every region. Mann-Whitney test (For test justification see §5.5.1) indicated that the AQ-10 scores did not differ by that, the suspected ASD (Mdn = 57.16) versus official diagnosis of ASD (Mdn = 62.76, U = 1431 p = .40). Thus, the two groups (officially diagnosed or suspected ASD) were combined. Likewise, in order to reduce the limitation of the HL sample, the Mann-Whitney test was used to determine the differences in the AQ-10 and SDQ scores between the two countries to consider combining them together, but the test shows a significant difference between the two groups as specific (HL in the UK & HL in the KSA) in the *hyperactivity/inattention* scores (U = 1,500 p= .009); therefore, the HL groups could not be combined.

As shown in Table 6.5 below, of the total sample, 47.3% from the UK respondents were parents of children with ASD, 4.6% parents of HL children, and 48.1% parents

of TD children. For the sample from KSA, parents of children with ASD comprise 47.6% of this sample, parents of HL children 4%, and parents of TD children 48.4%. The diagnosed conditions were not controlled in the data collection as the study was distributed online and participation was voluntary. Responses were received and recorded regardless of the diagnosed condition. Discussion of sampling limitation is presented in the methodology chapter, §5.6.4 and the concluding chapter, § 11.3.

Table 6.5: Participants' conditions (based on diagnosis)

Country	UK		KSA	
	F	%	F	%
ASD	62	47.3	59	47.6
HL	6	4.6	5	4.0
TD	63	48.1	60	48.4
Total	131	100	124	100

F: Frequency

6.6 Residency Status

Parents were asked to choose one of the following to describe the area they live in (Urban, Suburban, or Rural). As can be seen in Table 6.6, the majority of participants in the UK sample are from urban areas (50.4%), but the distribution may be acceptable due to the fact that the size of these areas is different. However, most of the completed questionnaires from the KSA are from an urban area, equivalent to 90.3% of the people who completed the questionnaire and answered this question. No responses from rural areas were received. Discussion of this limitation is presented in the methodology chapter, §5.6.4.

Table 6.6: Residency status

Country	UK		KSA	
	F	%	F	%
Urban	66	50.4	112	90.3
Suburban	47	35.9	10	8.1
Rural	12	9.2	0	0
Missing	6	4.6	2	1.6
Total	131	100	124	100

F: Frequency

6.7 Educational Placements

Table 6.7 presented the educational placements of children with ASD or HL in both countries' samples. Because the number of children with HL is small in both samples, the educational placement for each child was presented in stars (*) and the numbers in the table represent children with ASD. For example, 36 of the children with ASD in the UK sample, and 24 from the KSA sample were integrated with TD children and fully included with other children, so most of the children with ASD were integrated into mainstream schools. Another example of HL sample, four of the UK sample and two of the KSA sample are placed in special schools.

Table 6.7: Children's educational placement

Country	UK		KSA	
School placement	**F**	**%**	**F**	**%**
Full-time integrated with TD peers	36	58.1	24	40.7
Part-time integrated with TD peers	2*	3.2	7*	11.9
Special class in a general educational school	3	4.8	15**	25.4
Special school	11****	17.7	6**	10.2
Other	10*	16.1	7	11.9
Total	62	100	59	100

Each star (*) represent one of the children with HL

6.8 Playing Type

The type of playing is an essential aspect of this research because it classified players into groups and identified associations between their mental health and relationship scores. Respondents were asked whether their children played MC or OCG and whether they have played a multiplayer mode of MC (Table 6.8 – the type of play for each condition is presented §7.2 and 7.3). Eighty-four (64.1%) children of the UK sample and 45 (36.3%) of the KSA sample have played MC in multiplayer mode, whereas 24 (18.3%) of the UK respondents and 28 (22.6%) from the KSA sample have played MC in a single-player mode. Lastly, players who have not played MC, but have played another form of OCG comprise 19 (14.5%) children from the UK sample and 43 (34.7%) from the KSA sample. Some of the children from the samples have not played any type of OCG at all; therefore, 4 (3.1%) children from the UK sample and 8 (6.5%) from the KSA sample are excluded from the following analysis because they are not the target for this research.

Table 6.8: Type of playing among all conditions

Country	**UK**		**KSA**	
	F	**%**	**F**	**%**
Do not play (excluded)	4	3.1	8	6.5
Play OCG	19	14.5	43	34.7
MC In single-player mode	24	18.3	28	22.6
MC In multiplayer mode	84	64.1	45	36.3
Total	131	100	124	100

F: Frequency

6.9 Parents' Age

The age of parents was an optional question and was answered by some parents from each country. Table 6.9 presented that parents' ages were between 28 and 61 years, with a mean of 41.57, *SD*= 7.42 in the UK sample, and a mean of 39.34, *SD*= 5.22 in the KSA sample.

Table 6.9: Parents' age

Country	N	Min	Max	Mean	*SD*
UK	92	28	61	41.57	7.422
KSA	74	26	52	39.34	5.224

6.10 The Observations and Interviews

This study intended to have a number of observations and interviews from all condition groups, including children with ASD and HL, from the KSA. Parents or guardians of children from KSA were asked (at the last section of the questionnaire) whether they were willing to take part in the observations and interviews part. All children whose parents agreed to take part were emailed the PIS (as discussed in §5.3.2 and §5.6). All parents who were in favour of their children being observed and interviewed were themselves observed and interviewed. However, only three parents were interviewed, and four children were observed and then interviewed, and all of them were TD children who had not been identified with any disability. Further discussion of this issue is presented in the section on thesis limitations, §11.3. **Table 6.10** presents details on participants in the observations and interviews.

Table 6.10: Parents and children who took part in the observation and the interview

Playing Type		MC multiplayer	MC Single-player		Do not play
Age		13	8	10	8
Gender		Female	Female	Male	Female
AQ-10 score		2	3	3	0
SDQ	Total	7	10	17	18
	Emotional	0	0	3	7
	Conduct	2	3	6	5
	Hyperactivity	2	3	6	4
	Peer problems	3	4	2	2
	Prosocial	9	8	9	9

6.11 Summary and What Comes Next

This chapter is related to data on the demographics of the research sample and sought to understand critical related factors such as the age, gender, diagnosis, and type of playing of the players. The goal of presenting these data was to describe the range of respondents across both countries in simple tables, to classify participants into groups for the purpose of analysing the association between these variables and social-emotional and behavioural states including relationship skills. The next three chapters presented and discussed the results of the statistical analysis of the three research hypotheses (1) Children with ASD or HL play MC more than TD (Chapter 7); (2) The scores of the frequency of playing OCG, lifetime duration of playing MC, and MC frequency are associated with the SDQ scores (Chapter 8); and (3) The score of playing MC with others is associated with peer relationship problems score (Chapter 9). These chapters were analysed using different statistical methods (presented in §5.5.1) A series of visual presentations were created to help explain the relationships between the variables examined in this study.

CHAPTER 7: CURRENT USE OF OCG AND MC

7.1 Introduction

This chapter synthesises and discusses the results in light of the first research question of this study, namely do children with ASD or HL play OCG, in particular, MC more than TD children across the UK and KSA samples? This was an essential question that is used to explain the use of MC for children with ASD/HL. Here is a reminder of this hypothesis:

H_1 Children with ASD play MC more than TD.

H_0 There are no differences among groups regarding the type of playing.

This chapter aims to explain the extent of using OCG by children with ASD or HL in comparison to TD children. As stated in §5.3.3, quantitative data were obtained from self-report surveys completed by parents in two countries (UK and KSA) and three condition groups (ASD, HL and TD), analysed separately using a number of statistical tests (§5.5.1) to test for differences in cultures and conditions. Demographic information about the sample was presented in the previous chapter.

For this research hypothesis, and in order to test the difference in playing OCG, and particularly MC, among people with ASD compared to TD, chi-square tests were run for the playing group and the conditions because the data are categorical. After that, a descriptive statistic for the factor scores (preference to play alone, the frequency of playing OCG, lifetime duration of playing MC and MC frequency, and scores playing MC with others – descriptions for these factors are presented in § 5.3.3.1) among conditions was presented for comparison purposes. The questionnaire factors related to this chapter are discussed using statistical tests of analysis to identify characteristics such as mean and standard deviation (SD), as well as using the Mann-Whitney U test (described in § 5.5.1) to test the difference between the conditions in previously mentioned factors (§ 7.3). Since children with HL were not included in the hypothesis test because the sample size was too small to be meaningful, a

comparison of the mean is needed to give an impression about the differences between samples, taking into consideration that the sample sizes are not equal.

Afterwards, the chi-square test has been applied to test for differences between types of playing and gender (§ 7.5). Next, the Kruskal-Wallis test is used to determine if there were statistically significant differences between the type of playing (as an independent variable) and ASD severity (§ 7.7, measured through the AQ-10), as well as with age (§ 7.6) as continuous dependent variables. As stated earlier (§ 5.5.1), the Kruskal-Wallis H test is a non-parametric test for comparing independent samples, to test significant differences on a continuous dependent variable and a categorical independent variable. Lastly, nominal regression is performed (§7.3) to assess the presence of a relationship between the dependent variable (Playing group, as a categorical variable) and the combination of independent variables (Country, Conditions, Gender and Age). After that, the findings of this chapter are discussed (§ 7.8) in the light of three primary outcomes: condition differences, country differences and gender differences. The chapter then concludes (§ 7.9) by giving an overview of the main results and findings in light of the research question.

7.2 Hypothesis Test

In order to know whether there is a difference between the two countries and each condition in playing OCG and specifically with playing MC in this research sample, the chi-square test was run for the playing group versus countries and then the conditions. Chi-square tests were used because the variable data are categorical. It is vital to note that it may not be possible to test the hypothesis on the HL sample in both countries due to the sample size (UK= 6; KSA= 5; an in-depth discussion of this point is placed in the thesis limitations section, § 11.3). Firstly, the differences between the types of playing between the two countries are presented regarding the whole sample using the chi-square test because the data are categorical. Table 7.1 shows that the preferred type of play significantly differs by the country, χ^2 (2) = 20.93, $p<.001$.

Table 7.1: Chi-square tests for country and types of playing cross-tabulation and chi-square tests

	Types of playing[a]				Chi-square tests		
Country	OCG	MCS	MCM	Total	χ^2	Df	Sig.
UK	19	24	84	127			
KSA	43	28	45	116			
Total	62	52	129	243	20.934[b]	2	**.000**

a. MCS: MC Single-player; MCM: MC Multiplayer.
b. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 24.82.

Secondly, since there was a significant difference between the two countries, the two countries are analysed separately. The chi-square tests were run for the playing group versus the conditions. Chi-square tests (Table 7.2) show there are preferred types of play in the UK sample which significantly differed by the diagnosis condition, with children with ASD preferring to play MC in the multiplayer mode: $X^2(2, n= 121) = 7.43$, $p=.02$. However, no significant differences were presented in the preferred type of play by the condition in the KSA sample: $X^2(2, n= 111) = 4.72$, $p=.09$. Thus, the null hypothesis is rejected for the UK sample but is accepted for the KSA sample.

Table 7.2: Chi-square tests for the conditions and the types of playing

		Types of playing[a]				Chi-square tests		
Country		OCG	MCS	MCM	Total	χ^2	Df	Sig.
UK	ASD	5	10	47	62			
	TD	14	13	32	59			
Total		19	23	79	121	7.433[a]	2	**.024**
KSA	ASD	24	13	17	54			
	TD	15	14	28	57			
Total		39	27	45	111	4.725[b]	2	.094

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.26.
b. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.14.

7.3 Multinomial Logistic Regression to Assess Relationships with the Playing Group

Multinomial logistic regression was performed to assess relationships present between the dependent variable and a combination of independent variables . The multinomial logistic regression model is a form of binomial logistic regression model where the outcome variable (Playing group - dependent variable) is categorical and the independents are a continuous variable (age) and categorical variables (i.e., Country, Conditions and Gender). It should be noted that the dependent variables are mutually exclusive and exhaustive categories. To test the for multicollinearity, two options were followed: firstly, checking the correlation between the variables using the correlation diagnostic tool in running the logistic regression, and no higher correlation was observed (>.7). The second option was running a logistic regression and then using the collinearity statistics output of the logistic regression only; thus, this multicollinearity was not found within the model as tolerance values were greater than 0.1 (the lowest is 0.983), so it can be concluded that no problem with collinearity in this particular model was observed. Furthermore, to test for the linear relationship between any continuous independent variables (only age in this model) and the logit transformation of the dependent variable, the Box-Tidwell (1962) procedure was used to test for linearity (if an interaction is significant, there is a problem), and the p-value was .251, indicating no violations of the model assumptions. Finally, in checking for significant outliers, high leverage points or highly influential points, logistic regression models were run and diagnostics tools on each model were used. The standardized residuals did not have values greater than +3 standard deviations (the highest was 1.482), and no leverage values were found to be greater than 0.2 (the highest was .153), and no values of Cooks Distance were above 1 (the highest was .321). This confirmed that the model had met the assumptions of normality. All the assumption outcomes (SPSS output) can be found in Appendix 4, §B.

In this analysis, the distribution reveals that the probability of the model chi-square (35.750) was less than the level of significance of 0.01 (i.e. $p<.001$). This means that

the null hypothesis that there was no difference between the model without independent variables and the model with independent variables was rejected, and the existence of a relationship between the independent variables and the dependent variable was supported. The distribution in Pseudo R-Square table (Appendix 4, §B) reveals that 15.8% of the variability is explained by this set of variables used in the model. However, the classification accuracy rate of the model was 56.0% (see the classification table in Appendix 4, §B), which was below the proportional by chance accuracy criteria of 56.6%, which may question the usefulness of the model.

The existence of a relationship between the independent variables and the dependent variable was supported, $\chi 2 = 35.75$ (10), Nagelkerke $R^2 = .16$, $p < .001$. There is a significant relationship between the independent variable 'country' and 'children's gender' and the dependent variable ($p < .01$). The independent variables country ($\chi 2 = 22.71$ (2), $p < .001$) and gender ($\chi 2 = 9.85$ (2), $p < .01$) are both significant in distinguishing both categories of MC Multiplayer and MC Single-player of the dependent variable from the category OCG of the dependent variable (Table 7.3**Error! Reference source not found.**).

Survey respondents who were from the UK were 4.7 times are more likely (exp (B) = 4.66) to be in the group of respondents who play MC in multiplayer mode (DV category 3), and 2 times are more likely (exp (B) = 2.02) to be in the group of respondents who play MC in single-player mode compared to the group of respondents who have played other type of OCG (but have not played MC) (DV category 1).

Moreover, survey respondents who were male (code 1 for gender) were 3.6 times are more likely (exp(B)= 3.59to be in the group of respondents who play MC in multiplayer mode (DV category 3), and 1.5 times are more likely (exp(B)= 1.47) to be in the group of respondents who play MC in single-player mode (DV category 2), compared to the group of respondents who have played OCG (DV category 1) (full tables of SPSS output for the multinomial logistic regression analysis tables are placed in Appendix 4, §B). Overall, there is a significant relationship between the

independent variables (country and children's gender) and the dependent variable (the playing group), which supports the conclusions of Table 7.1 and Table 7.8. However, while the regression analyses met the assumptions of parametric analysis in the previous section (§7.3), it considered only main effects, as a sub-group analysis would not meet parametric assumptions when the data are broken down into subgroups; and therefore, follow-up tests are reported next to further investigate the main effects of the research groups following sections.

Table 7.3: Multinomial logistic regression assessment of relationships with the playing group

Playing group[a]		B	S.E.	Wald	df	Sig.	Exp(B)
MC Single-player	Intercept	-.863	1.128	.585	1	.444	
	Age	.026	.107	.058	1	.809	1.026
	[Country= UK]	.703	.396	3.150	1	.076	2.021
	[Conditions=ASD]	-.209	.393	.282	1	.595	.811
	[Conditions=HL]	-.517	.935	.305	1	.580	.596
	[Gender =M]	.384	.453	.720	1	.396	1.469
MC Multiplayer	Intercept	-2.321	1.013	5.254	1	.022	
	Age	.134	.092	2.104	1	.147	1.144
	[Country= UK]	1.540	.345	19.871	1	**.000**	4.665
	[Conditions=ASD]	-.063	.342	.034	1	.853	.939
	[Conditions=HL]	-.405	.821	.243	1	.622	.667
	[Gender =M]	1.277	.428	8.886	1	**.003**	3.587

a. The reference category is: OCG.
b. This parameter is set to zero for (Country=KSA; Conditions=TD; Gender =F) as it is redundant.

7.4 Additional Statistical Analyses

In this section, the data for this chapter is statistically described. It should be noted that these data reflect this research sample and may or may not be representative of all children as they were impacted by the advertising methods for this research. Firstly, to summarise the ratio of OCG and MC players based on the diagnostic

condition, it can be seen from Table 6.8 and Table 7.2 that a high number of respondents have played MC: 85% of the UK sample and 63% of the KSA sample. Therefore, high ratios of the sample have played MC. Secondly, according to Table 7.2, there was a significant difference in the type of playing in the UK based on the conditions. Ninety-two percent of the total ASD sample in the UK sample have played MC. Additionally, 55% of the entire ASD sample in the KSA sample has played MC. The difference between the choices of play among children in each country and condition was tested previously (§ 7.2).

7.4.1 Preference to play alone

As explained in § 5.3.3, the preference to play alone is related to social play and would allow us to know whether the child likes to play alone or not. Some children with ASD prefer to play alone rather than play with others due to social preference (e.g., Wolfberg, 2009). Thus, this question "Q1.5_1: My child plays alone" would allow the researcher to see whether the child prefers to play alone and if so, whether this is true for online games. Choices range between always (scored 4) to never (scored 0). Figure 7.1 shows a comparison of the score of playing OCG frequency among conditions. Children with HL in both countries' samples are more likely to play alone than TD children, but these data should be taken with caution because of the small HL sample size (UK= 6, KSA= 5).

In order to test differences between the condition and the mean scores of preference to play alone, the Mann-Whitney U test (described at § 5.5.1) was run for the ASD and TD groups. This test (Table 7.4) indicated that children with ASD are more likely to play alone than TD children - in the UK sample U= 784.5, p<.001, and in the KSA sample U= 933, p<.001. Overall, children with ASD are more likely to play alone than TD children in both countries.

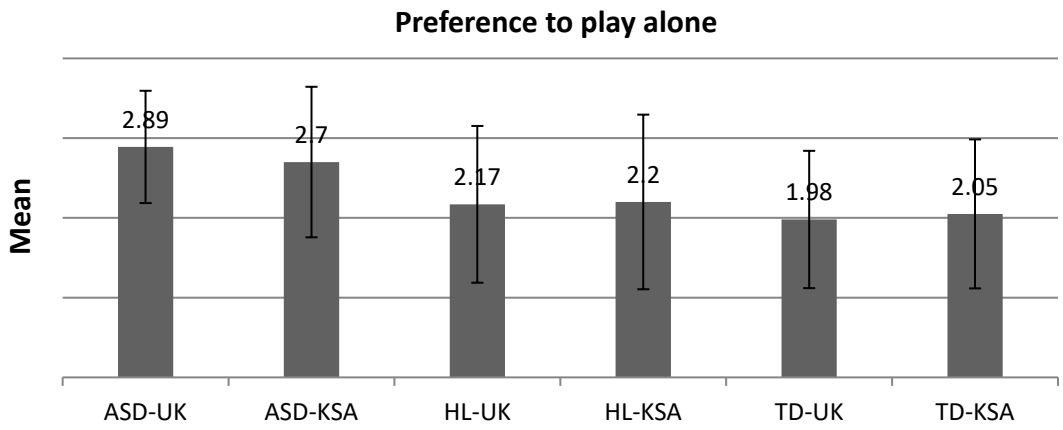


Figure 7.1: Mean of the preference to play alone

Table 7.4: Mann-Whitney ranks for preference to play alone

Ranks and test statistics[a]							
			N	Mean rank	Sum of ranks	Mann-Whitney U	Sig.
UK	Preference to play alone	ASD	62	77.85	4826.50		
		TD	59	43.30	2554.50		
		Total	121			784.500	**.000**
KSA	Preference to play alone	ASD	54	67.22	3630.00		
		TD	57	45.37	2586.00		
		Total	111			933.000	**.000**

a. Grouping Variable: Conditions

7.4.2 The frequency of playing OCG scores

As explained in § 5.3.3, this part has one questionnaire item (statement) that is treated and analysed as ordinal factors and aims to score the playing of OCG (frequency of playing OCG). A higher score means a higher frequency of playing OCG. This score is only recorded for participants who have not played MC because MC has a different frequency score, which is discussed in § 7.4.3. Figure 7.2 shows a comparison of the score of playing OCG frequency among conditions. No mean score for HL in the UK was reported because all the children in this sample have played MC.

In order to test differences between the condition and the mean scores of playing OCG frequency, the Mann-Whitney U test was run for the two groups, ASD and TD.

Children with HL are not included in this statistical test because of the small sample size. The test (Table 7.5) indicated no significant difference between conditions in the scores of playing OCG frequency in the UK sample where *U*= 17.5, *p*= .06, or in the KSA sample where *U*= 165.5, *p*=.66. The mean rank of playing OCG frequency scores is presented in Table 7.5.

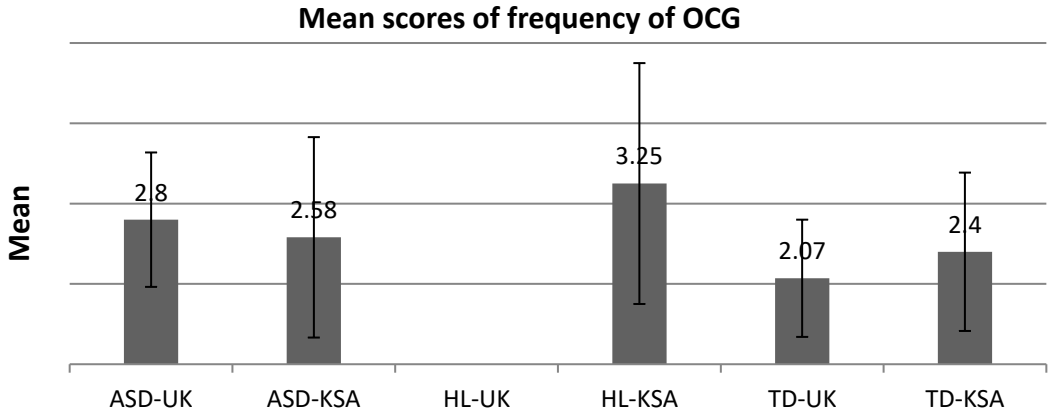


Figure 7.2 Mean of the frequency of playing OCG

Table 7.5: Mann-Whitney ranks for the frequency of OCG

Ranks and test statistics[a]							
			N	Mean rank	Sum of ranks	Mann-Whitney U	Sig.
UK	Frequency of OCG	ASD	5	13.50	67.50		
		TD	14	8.75	122.50		
		Total	19			17.5	.060
KSA	Frequency of OCG	ASD	24	20.60	494.50		
		TD	15	19.03	285.50		
		Total	39			165.5	.664

a. Grouping Variable: Conditions

7.4.3 Lifetime duration of playing MC and MC frequency

As discussed in § 5.3.3, one questionnaire item (statement) is related to the lifetime duration of playing MC, and another one is related to the frequency of playing MC. These are presented and are scored separately as ordinal factors. A higher score

means a higher frequency or a longer lifetime duration of playing MC (number of months and years). Children who have not played MC would not be able to be included in this part, as these two statements are about MC. Figure 7.3 shows a comparison of the scores of lifetime duration of playing MC and MC frequency between conditions.

In terms of the frequency of playing, Figure 7.3 shows that children with ASD from the UK sample have a greater lifetime duration of playing MC, and play MC more frequently than the TD children in the UK sample. Although the mean score of children with HL should be perceived cautiously because of the small sample size, children with HL in the KSA play MC less frequently compared to other children in this research sample. Regarding the lifetime duration of playing MC, Figure 7.3 shows that children with HL in the UK (n=6) have a long lifetime duration of playing MC compared to all other groups. However, the SD seems to be very high for some groups because the data are widely spread due to the sample size.

In order to test the difference between the conditions and the mean scores of the lifetime duration of playing MC and MC frequency, the Mann-Whitney U test was used between the two groups: ASD and TD. The test (Table 7.6) showed that children with ASD in the UK sample have a longer lifetime duration of playing MC (U= 860, p<.01) and play MC more often (U= 897, p<.01) than TD. However, no difference in the score of MC lifetime duration of playing MC and MC frequency between children's condition (ASD and TD) in the KSA sample was reported. Overall, children with ASD in the UK have a longer lifetime duration of playing MC and play MC more often than TD children.

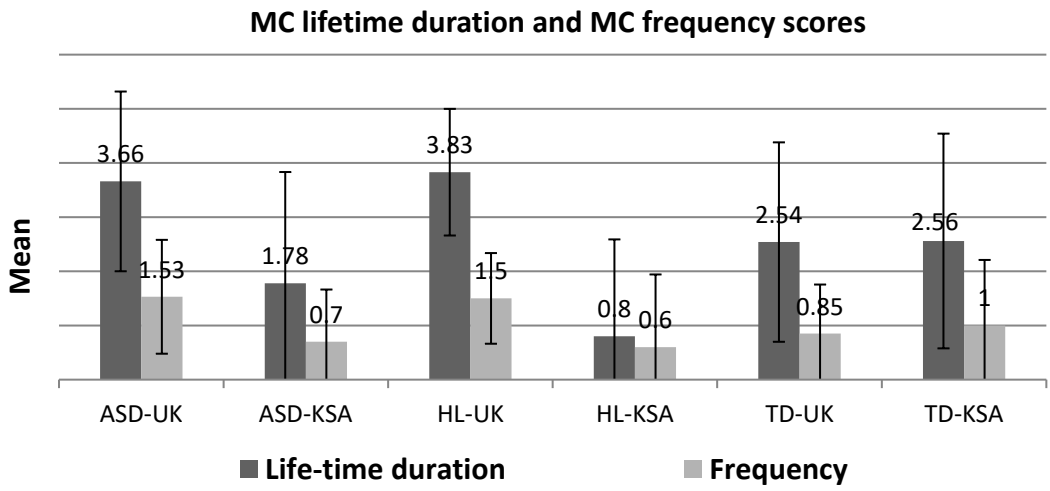


Figure 7.3 Mean of lifetime duration and frequency of playing MC

Table 7.6: Mann-Whitney ranks for the lifetime duration and frequency of playing MC

Ranks and test statistics[a]							
			N	Mean rank	Sum of ranks	Mann-Whitney U	Sig.
UK	Lifetime duration	ASD	57	58.91	3358.00		
		TD	45	42.11	1895.00		
		Total	102			860.000	**.003**
	Frequency	ASD	57	58.25	3320.50		
		TD	45	42.94	1932.50		
		Total	102			897.500	**.004**
KSA	Lifetime duration	ASD	30	34.98	1049.50		
		TD	42	37.58	1578.50		
		Total	72			584.500	.592
	Frequency	ASD	30	36.07	1082.00		
		TD	42	36.81	1546.00		
		Total	72			1082.000	.868

a. Grouping Variable: Conditions

7.4.4 Scores for playing MC with others

As presented in § 5.3.3, this statement aims to score playing MC with others, where parents were asked to respond to the question “Does your child play Minecraft in a multiplayer mode” (Q3.1). This question is designed as a frequency Likert scale, where participants are given five choices ranging from always (scored 5) to never (scored 1). A higher score means a higher frequency of playing MC with others. This score is reported only for participants who have played MC in a multiplayer mode. Figure 7.4 shows that conditions vary in this scoring of the frequency of playing MC with others. Children with HL in the UK have a higher mean of this frequency score than all other groups, although this finding should be perceived cautiously because of the sample size (n=5). No mean was presented for children with HL in the KSA because no one in that sample played MC in a multiplayer mode.

In order to see whether there is a significant difference between the condition and the mean scores of the frequency of playing MC with others, the Mann-Whitney U test was run between the two categorical independent groups: ASD and TD. Children with HL are not included in this statistical test because of the sample size (§ 11.3), and one of them was missing, as none of the children with HL in the KSA has played MC in a multiplayer mode. The Mann-Whitney test (Table 7.7) indicated that there was no significant difference between the scores of playing MC with others frequency in the UK (U= 683.5, p=.46) and KSA (U=206.5, p=.43) samples. The mean rank scores are presented in Table 7.7.

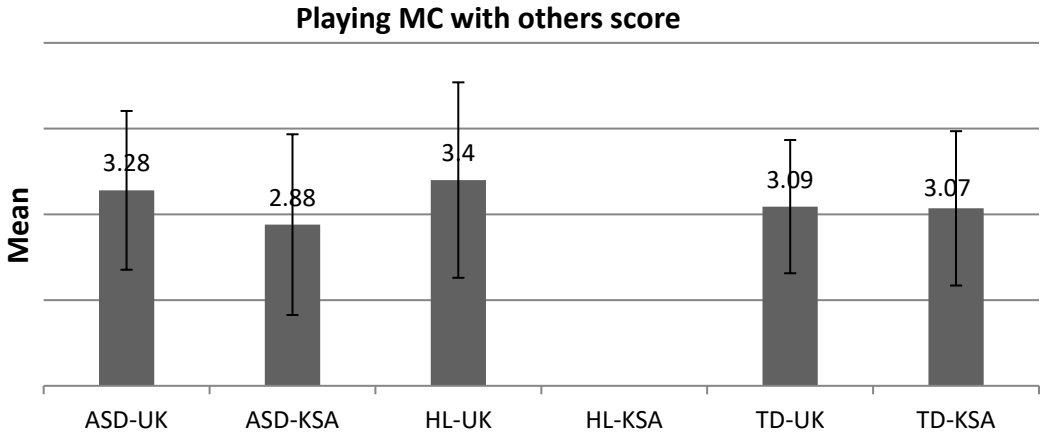


Figure 7.4 Mean of playing MC with others score

Table 7.7: Mann-Whitney ranks for the frequency of playing MC with others

Ranks and test statistics[a]							
			N	Mean rank	Sum of ranks	Mann-Whitney U	Sig.
UK	Playing MC with others	ASD	47	41.46	1948.50		
		TD	32	37.86	1211.50		
		Total	79			683.500	.463
KSA	Playing MC with others	ASD	17	21.12	359.00		
		TD	28	24.14	676.00		
		Total	45			206.000	.430

a. Grouping Variable: Conditions

7.5 Differences in Type of Play Used Between Boys and Girls

Because the gender of the participants does not show equal ratio (Table 6.4) and implies a higher number of boys than girls in the whole sample, the chi-square test was used to test differences between the types of playing based on gender. The chi-square result (Table 7.8) indicated that the preferred type of play significantly differs by gender in KSA ($X^2(2, N= 116) = 6.96$, $p=.03$), where girls play less frequently in multiplayer mode. However, there is no significant difference between the preferred type of play based on gender in the UK ($X^2(2, N= 127) = 4.61$, $p=.10$).

Table 7.8: Gender and types of playing cross-tabulation and chi-square tests

		Types of playing[a]				Chi-square tests		
		OCG	MCS	MCM	Total	χ^2	Df	Sig.
UK	Male	13	17	72	102			
	Female	6	7	12	25			
	Total	19	24	84	127	4.614[b]	2	.100
KSA	Male	31	23	42	96			
	Female	12	5	3	20			
	Total	43	28	45	116	6.962[c]	2	**.031**

a. MCS: MC Single-player; MCM: MC Multiplayer.
b. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.74.
c. 1 cell (16.7%) has expected count less than 5. The minimum expected count is 4.83.

7.6 Is the Type of Playing Influenced by Age?

The age of the sample range is between 8 and 14 years old (discussed in § 5.3.2). The Kruskal-Wallis test was used to test differences between the playing groups (types of playing) and the age (test justification can be found at § 5.5.1). A Kruskal-Wallis H test (Table 7.9) showed that there is no significant difference in playing groups for the ASD-UK sample, $\chi2(2, N= 62) =2.003$, $p=.36$, and the ASD-KSA sample, $\chi2(2, N= 54) =5.59$, $p=.06$. This difference is also not statistically significant in the TD-UK sample, $\chi2 (2, N= 59) = 2.14$, $p=.34$, or the TD-KSA sample, $\chi2 (2, N= 57) = 2.91$, $p=.23$. Overall, there is no significant difference in the age among all groups from both countries. The mean rank of the child's age is presented in Table 7.9.

Table 7.9: Kruskal-Wallis ranks of child's age and type of playing

Ranks of child's age and test statistics[a,b]

		Playing group	N	Mean rank	χ^2	Df	Sig.
UK	ASD	OCG	5	20.80			
		MC Single-player	10	31.65			
		MC Multiplayer	47	32.61			
		Total	62		2.003	2	.367
	TD	OCG	14	25.14			
		MC Single-player	13	28.50			
		MC Multiplayer	32	32.73			
		Total	59		2.140	2	.343
KSA	ASD	OCG	24	27.96			
		MC Single-player	13	34.65			
		MC Multiplayer	17	21.38			
		Total	54		5.598	2	.061
	TD	OCG	15	27.03			
		MC Single-player	14	24.00			
		MC Multiplayer	28	32.55			
		Total	57		2.911	2	.233

a. Kruskal-Wallis test
b. Grouping variable: Playing group

7.7 Difference between ASD Severity and Type of Playing

In order to see whether there is a significant difference between the playing groups (types of playing) and the score of AQ-10 for the ASD sample, the Kruskal-Wallis test was run (test justification can be found at § 5.5.1). This test showed a significant difference in the ASD severity score among playing groups in the KSA sample, $\chi 2$ (2, N= 54) =14.72, *p*=.001. This means that children with a higher score of AQ-10 are more likely to play MC in single-player mode. However, no significant difference in ASD severity among playing groups in the UK sample was reported, $\chi 2$ (2, N= 62) = 2.14, *p*=.34. The mean rank of the child's AQ-10 scores is presented in Table 7.10.

Table 7.10: Kruskal-Wallis ranks of AQ-10 and type of playing

Ranks of AQ-10 and test statistics[a,b]

Country	Playing group	N	Mean rank	χ^2	Df	Sig.
UK	OCG	5	20.50			
	MC Single-player	10	32.00			
	MC Multiplayer	47	32.56			
	Total	62		2.142	2	.343
KSA	OCG	24	19.83			
	MC Single-player	13	39.58			
	MC Multiplayer	17	29.09			
	Total	54		14.717	2	**.001**

a. Kruskal-Wallis test
b. Grouping Variable: Playing group

7.8 Discussion

In this section, the findings presented in this chapter are presented and discussed in the light of three primary outcomes related to differences with the condition, country differences and gender.

7.8.1 MC seems to be a favoured place for children with ASD

This study reported that there is strong evidence that MC seems to be a preferable and special place for children with ASD in both countries, though differences between

the two countries are presented later on in this chapter. Four fundamental outcomes are essential in understanding the role of the diagnostic condition of children in this sample on the role of OCG, which is vital for the current state of knowledge about relationships between children with diagnosed conditions and games. This would be fundamental for future research and practice in understanding the role of games in the development of children with special needs.

7.8.1.1 Differences in the type of playing between the conditions

Firstly, in the finding of this chapter's hypothesis, children with ASD play MC in a multiplayer mode significantly more than TD children in the UK (§ 7.2). Secondly, Table 7.10 shows that children with ASD with a higher score of AQ-10 are significantly more likely to play MC in single-player mode in the KSA sample only. Furthermore, children with ASD in the UK have a significantly longer lifetime duration and higher frequency of playing MC than TD children (Table 7.5).

These three findings of differences in respect of the conditions may reveal two possible explanations. Firstly, there might be cultural differences in managing and supervising children with ASD (cultural views on disability were discussed in § 5.6.4). For example, Mashat et al. (2014) investigated the use of social networks for Arab adults with ASD in social situations, such as family relations and friendships. The researcher interviewed 12 experts or members of staff who specialised in ASD from 11 centres in different cities in KSA and three adult males with ASD. The participants reported a lack of technologies in Arabic for individuals with ASD, and none of the three adults with ASD used Facebook or Twitter, although two of them reported using WhatsApp. This result is the opposite of what has been reported by studies in the Western world in respect of children with ASD, where a higher use of technologies has been reported. For example, Mazurek and Wenstrup (2013) reported that children with ASD in the US spent more time on media than children without ASD. Mashat et al.'s study may illuminate the reason why children with ASD in the KSA sample play MC less than the TD children in both countries, and less than children

with ASD in the UK sample, as they generally are online less (as presented in Figure 7.3 and Figure 7.4).

Another possible explanation is that MC may provide children with ASD in the UK with more socialisation activity. This is presented through the result of the hypothesis testing, where children with ASD play MC in a multiplayer mode more than others (Table 7.2). Autcraft might be a key to this, as it is a safe environment in which the server is controlled and supervised by people with a connection to ASD. Ringland et al. (2015) explored and expressed how parents of children with ASD create and manage a safe environment through Autcraft. They found that risk was reduced, and parents and children felt emotionally, physically and socially secure, although children complained about being controlled. In addition, Ringland et al. (2016a) and Ringland (2019) noted that Autcraft supports children's self-regulation and community engagement, and helped them to collaborate, express and share their emotional feelings safely with others. However, it is important to note that Autcraft cannot be played in Arabic because the communication and verbal interaction is currently limited to English. This may explain the differences among the conditions in the MC lifetime duration and MC frequency, where it was statistically significant in the UK sample only (Table 7.6), and the number of MC players among the ASD sample in the UK was higher than the other groups.

Altogether, although these differences might be due to the condition (the diagnosis) as discussed, response bias can always be presented as the research is voluntary. Therefore, it cannot be fully assumed that children with ASD play MC in multiplayer more than others in the whole ASD population, because autism is a spectrum and all children are different from each other. The three differences in types of playing based on the conditions that were presented previously might be due to the fact that the focus of the recruitment of children into the study was on OCG and specifically MC. A large number of people may have taken this study based on the focus of the participants' information sheet (PIS), where MC was mentioned and repeated many times. This might have affected respondents' decisions to participate and therefore biased recruitment in favour of those who play MC (recruitment limitation is

discussed in § 11.3). However, it can be argued that the differences between the MC multiplayer and single-player modes were not influenced by the study's advert or the PIS, as both modes come as categories of the MC; therefore, children with ASD in the UK who play MC are more likely to play MC in the multiplayer mode than TD children.

7.8.1.2 Children with ASD and playing alone versus playing with others

The fourth fundamental outcome regarding the differences in the type of playing between conditions in this chapter is that children with ASD are significantly more likely to play alone than TD children in both countries (Table 7.4), although they are also significantly more likely to play MC in a multiplayer mode than TD children in the UK sample (Table 7.2). This might seem like a contradiction, as it is if they want to be social but without being social. However, it is important to remember that most of the research with children with ASD is undertaken by TD people, which may limit the degree of understanding of the phenomena. For example, Jaswal and Akhtar (2018) bring an interesting dialogue, challenging that what may appear to us (as TD people) as being autistic behaviour may not be truly what is actually occurring for a person with ASD. The authors challenged that what appear to us as lack of social interest (e.g., lack of eye contact and/or pointing, motor stereotypies, and echolalia) using robust evidence, such as autistic testimonies for these 'unusual' behaviours. They argue that taking these behaviours as signs for lack of social interest can negatively affect how people with ASD are treated and how these behaviours are studied. Indeed, Delafield-Butt, Trevarthen, Rowe and Gillberg (2018) demonstrated that behaviours such as aloneness or self-protective isolation could be misinterpreted as a lack of social motivation or sociability even though children with ASD, actually, intend to have meaningful engagement and shared learning (Trevarthen & Delafield-Butt, 2013b).

In responding to this outcome (i.e., children with ASD are significantly more likely to play alone in both countries, but at the same time are more likely to play MC in a multiplayer mode for the ASD sample in the UK), there are three possible explanations. The first and most important one is allied with Jaswal and Akhtar's

(2018) argument that what may appear or perceived by parents (who selected that their children like to play alone) is not what actually is true for a person with ASD. In other words, although parents thought or possibly believe that their children like to play alone, children show that they are more likely to play with others or at least around others in the multiplayer mode. The second possible explanation is that parents have been told that children with ASD favour being alone and feel more relaxed when left alone (Chilvers, 2007; Bertilsdotter-Rosqvist et al., 2015), which may make them believe and only watch signals of preference of loneliness. Jaswal and Akhtar (2018, p.37) stated,

> One negative consequence of assuming that autistics are socially uninterested is that it can lead researchers to interpret autistic participants' behavior as indicating that they are socially uninterested, even though that interpretation is not made about non-autistic participants who behave in the same ways.

A third possible explanation is that children with ASD in this sample may prefer to play alone in the physical playing where it may require more physical and sensory interaction, but not in an online environment (Ringland, 2019). This is because the preference to play alone question in this study's questionnaire did not differentiate online environment versus the physical environment (for review, see the questionnaire, § 3 in appendix 2). Therefore, the outcomes of this section illustrate that children with ASD, especially in the UK, are more interested in playing in a multiplayer mode even though their parents thought their children significantly prefer to play alone. This outcome and these possible explanations highlighted the need for more research to be done by autistic people and analysed within their own perspectives

7.8.2 MC is widely spread in the UK sample

Some of the differences between the two countries have been discussed in the condition section as it is more relevant there, such as that children with ASD play MC in a multiplayer mode significantly more than TD children in the UK, but not in the KSA. In terms of the differences between the two countries, it is essential to recall

that a significant relationship was found between the country and the playing group (**Error! Reference source not found.**Table 7.3). Respondents who were from the UK were 4.7 times more likely to be in the group who play MC in multiplayer mode compared to the group of survey respondents who have played OCG, (but not MC) (Table 7.3**Error! Reference source not found.**); however, this also might be a result of biased recruitment in favour of those who play MC. Secondly, in terms of playing MC, there is a significant difference in the mean score of lifetime duration of playing MC and MC frequency, where children with ASD in the UK have a longer lifetime duration of playing MC and play MC more often than TD children, but no significant difference between conditions was presented in the KSA sample (Table 7.6). Also, the results also show that there are significant differences between the country and the preferred type of play (Table 7.1).

These outcomes confirmed the findings of Newzoo (2013), who reported that the UK is the fifth biggest country in the gaming market and has more than 34.7 million gamers. Then, in 2016, the size of the online population from the UK grew to 61.1 million, and 52% of them play games (Newzoo, 2016). KSA, however, is the nineteenth biggest country in the gaming market, and 76% of the population is considered to have Internet access (Newzoo, 2018), which is not limited to online games. However, there is no identifiable official estimation of the number of gamers in KSA. This might be due to the fact that there is no identifiable study of gaming, which might be considered new to a developing country.

Thirdly, regarding playing MC with others, children with ASD in the UK play MC with others more frequently than TD children in the UK, whereas TD children in KSA play MC with others more than children with ASD; however, these differences are not significant (Table 7.7). This may support the previous possible explanation for the difference between the uses of MC across the two countries, where children with ASD in the UK might benefit from having the special version of MC, Autcraft, which offers a place for multiplayer interaction. Another possible explanation is that TD children from KSA are allowed to play MC with others more frequently due to some cultural factors. Mashat et al. (2015) summarised and presented a number of such

cultural factors through the framework for autistic Arabs' social communication and interaction technology (FAASCIT). These factors include, but are not limited to, spoken language and Internet language (using English as a second language and using icons or abbreviations), lifestyle system (where technologies were not designed for a non-Western lifestyle), gender and age differences (where gender and age play a massive role in the use of technology), personal information (different definitions of personal privacy, and stigma related to that, e.g., sharing female names), conservatism (in many parts of life including views on relationships, communicating with the opposite gender, or having a disability), and Internet access (where some areas of the region have no or limited access to the Internet). Although this framework is related to the use of technology in general in the Arab world, these factors might explain the differences between the countries in the preferred type of play examined in this research.

7.8.3 Males are more likely to play MC in multiplayer mode

This study reported a significant relationship between gender and the playing group. Girls are less likely to play in MC multiplayer mode in the KSA sample (Table 7.8). Also, the results of the multinomial logistic regression (Table 7.3**Error! Reference source not found.**) show that males were 3.5 times more likely to be in the group of survey respondents who play MC in multiplayer mode, rather than the group of who have played other type of OCG. Similar outcomes have also been found in the previous literature, where some studies show that boys play OCG or video games more than girls (e.g., Royse et al., 2007; Lucas & Sherry, 2004; Southgate et al., 2018). However, some recent studies show that 46% of gamers across 13 countries, including the UK, are female (Osborn, 2017) indicating no major differences. This is similar to the outcomes of Miller and Robertson (2011) who found no difference in gaming attitude between males and females students. Interestingly, Mavoa, Carter, and Gibbs (2018) reported, further, that there were no gender differences in MC players aged 9 to 12 years old (similar to the age criteria of this thesis); however, there were statistically significant difference between boys and girls aged 3 to 8 years old, where boys play

MC more than girls. Nevertheless, in the following, three possible explanations for differences in gender outline in the outcome of this chapter are discussed.

The first possible commentary is that about one-third of the sample for this study was children with ASD, which is found three to four times more often in males than in females. This could be a reason for having more boys in the sample. However, girls with ASD also tend to be underdiagnosed, which is an essential issue for gender differences in ASD prevalence ratios (Halladay et al., 2015). The second potential explanation is that the differences might be due to some cultural aspect (Baek & Touati, 2017), especially with KSA, as the results of this chapter also show few girls play MC in multiplayer mode. This may occur due to the fact that some parents in KSA do not allow girls to play in the multiplayer mode due to conservatism because it would involve interaction with boys (Heble, 2007), so girls may have been given limited freedom to use technology compared to boys (Alolyan, 2015). The third probable factor is that MC might be a game that has unequal gender preferences. Yee (2015) surveyed over 100,000 Minecraft players and identified unbalanced gender (79% male, 19% female). However, this cannot be proved because it can happen by chance as the sampling method for my study and Yee's study was purposeful. Some previous studies (Appendix 1) on MC have only male participants (e.g., Hollett & Ehret, 2015), but others include female participants (e.g., Nebel et al., 2017b). Thus, no study reported specific gender issues, and this could be a sample selection issue.

Contrary to expectations, this study did not find a significant difference between playing groups based on the sample's age for all samples (Table 7.4). This is similar to the outcomes of a recent study in Australia conducted by Mavoa et al. (2018), who found no significant age difference between playing in a single player or multiplayer mode. Some reports have shown that age plays an essential role in the preference of MC, such as Schuster et al. (2015) who reported that older participants experienced some technical problems and did not enjoy the MC experiment. A possible explanation for this might be that this study limited the participation to a narrowed

age scale (8 to 14), and it took this age impact into consideration when seeking participants (the sample age of this thesis can be found at § 5.3.2 and § 6.2).

7.9 Chapter Conclusion

This chapter examined whether children with ASD or HL play OCG or specifically MC more than TD children across the UK and KSA samples. The findings show a significant difference in the type of play between the two countries (Table 7.1); therefore, each country has been examined independently. Children with ASD in the UK sample only are more likely to play MC in the multiplayer mode (Table 7.2), have a longer lifetime duration of playing MC, and play MC more often than TD children (Table 7.6); hence, the null hypothesis is rejected for the UK sample, but is accepted for the KSA sample. Furthermore, children with ASD were more likely to play alone than the TD children in both countries (Table 7.4).

Interestingly, children with a higher score of ASD severity in the KSA sample are more likely to play MC in single-player mode (Table 7.10). The results also show that girls in the KSA sample are less likely to play MC in the multiplayer mode (Table 7.8). However, there was no significant difference between the scores of playing OCG frequency (Table 7.5) or playing MC with others (Table 7.7) in both countries' samples. Age also has no significant role in the type of playing for the ASD and TD samples from both countries (Table 7.9).

These findings are discussed in the light of three primary outcomes related to differences with the condition, country differences and gender. Two explanations were discussed in respect of the conditions differences - cultural differences in managing and supervising children with ASD, and children with ASD in the UK with more socialisation activity (e.g., Autcraft). In addition, three possible explanations were presented in regarding these outcomes, children with ASD are more likely to play alone in both countries, but at the same time are more likely to play MC in a multiplayer mode for the ASD sample in the UK. Explanations are mainly related to how the behaviours of children with ASD have been received and interpreted.

Overall, these outcomes are significant because it shows that children with ASD are more engaged with the multiplayer mode in the UK sample, and it raises many questions regarding how the interest of children with ASD in KSA on the subject of gaming may have been treated. However, OCG or precisely MC is usually an open-world format so no unique forms of play can be recommended over another; but further examination of the impact of these games on all children's social-emotional and behavioural outcomes is needed, which is presented in the next chapter.

CHAPTER 8: ASSOCIATIONS OF MC WITH SOCIAL-EMOTIONAL AND BEHAVIOURAL OUTCOMES

8.1 Introduction

This chapter synthesises and discusses the results in light of the second research question, namely whether there is an association between playing MC and children's social-emotional and behavioural outcomes, as assessed through the Strengths and Difficulties Questionnaire (SDQ) (presented in § 5.3.3.1)? This chapter aims to explore the extent of this association for ASD or HL children in comparison to TD children. The SDQ was not administered for assessment purposes; instead, it was used to identify the correlation between types of playing and the SDQ scores. Data were obtained from self-report surveys completed by parents in the two countries (UK and KSA), and analysed separately, as the differences across cultures are vital. As discussed in § 5.5, data were analysed using a number of statistical tests using the SPSS software package. Demographic information on the sample was presented in Chapter 6.

In order to know whether there is an association between playing OCG (stressing MC; presented in § 5.3.3.1) and children's social-emotional and behavioural outcomes, correlation tests were used (Table 8.1), as mentioned in § 8.2; though, correlation does not mean causation. Tests were run among each condition separately for comparison purposes, although it was not possible to include the HL sample in both countries in the tests due to the sample size (discussed in the thesis limitations, § 11.3). Differences in the mean of the total difficulties scores of SDQ among groups of conditions and playing groups are presented (Figure 8.1) followed by a Kruskal-Wallis test (Table 8.3) for the UK sample, and one-way ANOVA for the KSA sample (Table 8.4) to test the significance of these differences (justification of statistical tests can be found in § 5.5.1). To provide in-depth predictability, multiple regressions were run (Table 8.2) to predict the total difficulty score. Lastly, the findings of this chapter are discussed in light of playing OCG or specifically MC for each condition and country

samples. The chapter then is concluded by presenting an overview of the main findings in light of this research question.

8.2 Hypothesis Test

As stated in § 1.2 and expanded on in Chapter 4, several studies found that MC is helpful for players in the general population, and has improved their social skills in general, such as sharing, collaboration, communication and engagement skills (e.g., Bebbington & Vellino, 2015; Callaghan, 2016; Cilauro, 2015; Hong-An, 2016; Hollett & Ehret, 2015; Rexhepi et al., 2018; Overby & Jones, 2015; Nebel et al., 2016; Voiskounsky et al., 2017; Willett, 2018). Thus, this study hypothesises that the scores of lifetime duration and frequency of playing MC (these variables are presented in § 5.3.3.1) are associated with SDQ scores. The following is the research hypothesis:

- H_1 Scores of the frequency of playing OCG, lifetime duration of playing MC, and MC frequency are associated with the SDQ scores.
- H_0 There is no association between the score of the frequency of playing OCG, lifetime duration of playing MC, and MC frequency with the SDQ scores.

To test this hypothesis, Spearman's rho correlations test was used to see whether there is a correlation between SDQ scores and the other factor variables (i.e., the frequency of playing OCG – this is for children who have not played MC for comparison with MC, lifetime duration of playing MC and MC frequency scores). Spearman rank correlation is used because the variables are not normally distributed; however, Pearson correlation was used with the total difficulties scores for the KSA sample because the data are normally distributed, as mentioned in § 5.5.1.

It is also important to note that multiple testing problems occur when a set of statistical inferences are run simultaneously, increasing the family-wise error rate, i.e., the probability of making one or more false discoveries as a result of performing multiple hypotheses tests (type I errors). There are multiple methods used by researchers to reduce the chance of making false discoveries, such as adjusting the significance level and using the Bonferroni correction, which is needed because the more tests are run, the more likely someone is to get a significant result. In this

analysis, the adjusted significance threshold of α = 0.01 is used, i.e., using a more conservative p-value to reduce the chance of these errors.

For the UK sample, Table 8.1 shows one significant correlation that higher frequency of playing OCG is associated with higher prosocial behaviour scores (r_s =.432, p< .01) for the TD group. Similarly, one significant correlation can be observed in the KSA sample, of that a higher frequency of playing OCG is associated with higher peer relationship problems (r_s =.341, p<.01.); however, these two correlations were not presented for factors related to MC nor for children with ASD. Overall, the null hypothesis cannot be rejected, as there is not enough evidence to support the alternative hypothesis.

Table 8.1: Correlations matrix with SDQ outcomes

Correlations Matrix

Country			Total difficulties	Emotional symptoms	Conduct problems	Hyperactivity/ inattention	Peer relationship problems	Prosocial behaviour
UK	ASD	Frequency of OCG	-.092	-.066	-.096	-.105	-.046	.106
		MC lifetime duration	-.262	-.104	-.18	-.246	-.154	.244
		MC frequency	.199	.149	.083	.022	.137	-.052
	TD	Frequency of OCG	-.140	-.092	-.289	-.125	-.170	**.432****
		MC lifetime duration	-.141	-.201	-.179	-.127	-.085	.031
		MC frequency	-.172	-.207	-.161	-.109	-.183	.038
KSA	ASD	Frequency of OCG	.073	.041	.234	.126	-.118	-.135
		MC lifetime duration	-.018	-.09	-.099	.08	.082	.284
		MC frequency	-.001	.019	.097	-.007	.135	.142
	TD	Frequency of OCG	.310	.248	.147	.192	**.341****	-.197
		MC lifetime duration	-.077	-.107	-.092	-.016	-.025	-.077
		MC frequency	.041	-.12	-.05	.223	-.057	-.089

** p<.01

8.3 Multiple Regression to Predict the Score for Total Difficulties

Multiple regression is performed to predict the total difficulties score of a number of predictors (ID variable, discussed in § 5.3.3.1). Multiple regression allows a more sophisticated exploration of the interrelationship among a set of significant variables that have been explained in the previous parts, i.e. country (UK and KSA), conditions (ASD and TD), child's gender (boys and girls) and age, frequency of playing OCG, MC lifetime duration, and MC frequency, playing MC with others) in one model (full tables of SPSS output are placed in Appendix 4, C). Multiple regression has been used to make much more powerful and accurate predictions about the total difficulties score.

The assumptions of the multiple regression provided support for the significance of the model. The linearity of the variables were assessed using scatterplots to plot the predictor variables with the total difficulties score, and can also be observed in the figure which includes the regression standardized residuals against the predicted values. The residuals appear randomly scattered, which also is used to visually observe the homoscedasticity assumption that had been met.

Independence of residuals was assessed using the Durban Watson Statistic of 1.877. Multicollinearity was not found within the model as tolerance values were greater than 0.1 (the lowest is 0.487). The studentised deleted variables did have one value that is greater than +3 standard deviations (one case had a score of 39, and appears as an outlier in the casewise Diagnostics and also when running the boxplot for the total difficulties score); therefore, it was removed from this regression model only and the model was re-run. After that, the studentised deleted variables did not have values greater than +3 standard deviations (-2.595, 2.284), and no leverage values were found to be greater than 0.2 (.03351, .11349), and no values of Cooks Distance were above 1 (.00000, .04263). This confirmed that the model had met the assumptions of normality.

The full model shows that these variables can significantly predict the score of total difficulties, F (8, 230) = 6.891, $p<.001$, R2 = .212 and explained 18.4% of the variance

in the total difficulties score. However, as shown in Table 8.2, only one variable (conditions) made a unique significant contribution to the model; thus, conditions can significantly predict the total difficulties score (β= -.407, *p*<.001).

Table 8.2: Multiple regression predicting total difficulties score

	B	S.E.	Beta	t	Sig.
Country	.298	.958	.020	.311	.756
Conditions	-3.095	.470	-.407	-6.586	**.000**
Child's gender	-.394	1.263	-.020	-.312	.756
Child's age	-.264	.261	-.064	-1.011	.313
Frequency of playing OCG	.437	.448	.063	.976	.330
MC lifetime duration	-.415	.322	-.108	-1.286	.200
MC frequency	.898	.520	.127	1.726	.086
Playing MC with others	-.384	.426	-.077	-.901	.369
Country	26.582	3.784		7.024	.000

Dependent variable: Total difficulties

8.4 Differences in the Mean of Total Difficulties Scores

While the regression analyses met the assumptions of parametric analysis in the previous section (§8.3), it considered only main effects, as a sub-group analysis would not meet parametric assumptions when the data are broken down into subgroups; and therefore, follow-up tests are reported next to further investigate the main effects of the research groups in this section. Figure 8.1 shows the differences in the mean of total difficulties scores among the sample groups. Higher scores of total difficulties mean abnormal outcomes (scoring of the total difficulties was introduced in § 5.3.3.1). Figure 8.1 is useful as it includes children who have not played MC for comparison purposes; however, data for children with HL should be considered cautiously because of the sample size issue (see the thesis limitation, § 11.3). In order to see whether there is a significant difference in the mean scores of the total difficulties (measured by the SDQ) among the playing groups (the type of playing),

the Kruskal-Wallis test was run for the UK sample because the total difficulties scores are not normally distributed. This test (Table 8.3) showed that there was no significant difference in the mean score of total difficulties among playing groups in the ASD children, χ2 (2, N= 62) = .119, *p*=.94, nor in the TD sample, χ2 (2, N= 59) = 5.158, *p*=. 07.

Table 8.3: Kruskal-Wallis test for the difference in the total difficulties scores between the playing groups in the UK sample

Ranks of total difficulties scores and test statistics[a,b]

Condition	Playing groups	N	Mean rank	χ^2	Df	Sig.
ASD	OCG	5	34.10			
	MC Single-player	10	30.90			
	MC Multiplayer	47	31.35			
	Total	62		.119	2	.942
TD	OCG	14	38.82			
	MC Single-player	13	25.08			
	MC Multiplayer	32	28.14			
	Total	59		5.158	2	.076

a. Kruskal-Wallis test
b. Grouping variable: Playing groups

For the KSA sample, one-way ANOVA is used to find the differences of the means of the total difficulties score across the playing groups because total difficulties score is normally distributed (see § 5.5.1 for more about the normality test). The ANOVA table (Table 8.4) shows that there was no difference between playing groups in the ASD sample as determined by one-way ANOVA (F(2, 51) = 2.243, *p*= .116) nor for the TD sample (F(2, 54) = 1.316, *p*= .277). Because one-way ANOVA cannot tell which groups are different, it can be supplemented by a post hoc test (i.e., Tukey's HSD) to discover which specific groups' means are different. However, an ad hoc test is not needed here because no significant differences were reported, which indicates that the total difficulties scores are not significantly different between playing groups.

Table 8.4: One-way ANOVA test for the difference in the total difficulties scores between the playing groups in the KSA sample

ANOVA

Conditions		Sum of squares	df	Mean square	F	Sig.
ASD	Between Groups	126.269	2	63.134	2.243	.116
	Within Groups	1435.435	51	28.146		
	Total	1561.704	53			
TD	Between Groups	165.807	2	82.903	1.316	.277
	Within Groups	3402.755	54	63.014		
	Total	3568.561	56			

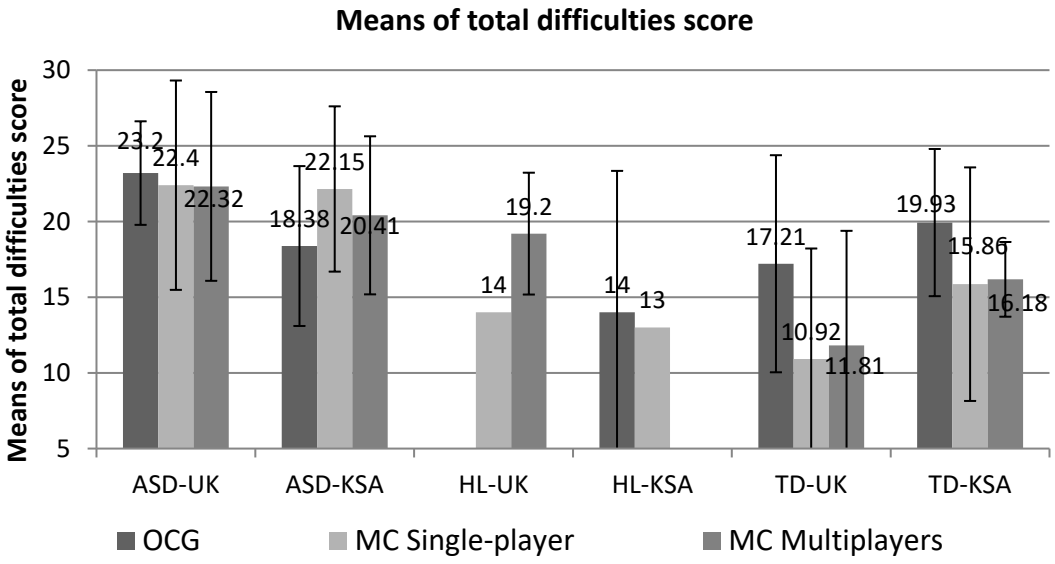


Figure 8.1: Differences in the mean of the total difficulties scores

8.5 Discussion

As stated in § 1.2, this research mainly concerns the association of OCG, and particularly MC, with the social-emotional and behavioural outcomes of children with special needs. It was found that conditions can significantly predict the total difficulties score (β= -.40, *p*<.001) (Table 8.2). This indicates that children with ASD are more likely to have a higher total difficulty score than TD children, which already has been raised by other research (i.e., that they have higher mental health

problems) (e.g., Baron-Cohen & Bolton, 1993; Chilvers, 2007). However, a Kruskal-Wallis H test for the UK sample (Table 8.3) showed no significant difference in the mean score of total difficulties among playing groups in the ASD sample. Similarly, the one-way ANOVA test (Table 8.4) indicated no significant difference in the mean score of total difficulties between the playing groups in the ASD sample in KSA. This may indicate that the type of playing is not associated with the total difficulties scores, though it should be noted that this is not a causation statement and is discussed further below. Since no significant differences in the mean score of total difficulties were reported, the discussion in this chapter is guided by associations of the total difficulties scores with playing OCG or mainly playing MC (more information about the total difficulties scores can be found at § 5.3.3.1).

As discussed in § 5.3.3.1, the frequency of playing OCG score aims to identify the incidence of playing OCG. This investigation indicates that a higher frequency of playing OCG is associated with and higher peer relationship problems (r_s =.341, p<.01) for TD children in the KSA sample. This association corresponds with the findings of some previous studies. For instance, Lobel et al. (2017) demonstrated that gaming frequency was associated with increases in children's internalising problems and anxiety and depressive symptoms. But, a different outcome was found in the TD sample in the UK (Table 8.1; i.e., higher frequency of playing OCG is associated with higher prosocial behaviour scores), pointing out one of the cultural factors.

Moreover, previously mentioned correlations (i.e., regarding the TD-KSA group of this thesis,) has verified the result of a previous study done by Page et al. (2010), who studied whether greater screen use would be associated with higher psychological difficulties, using the SDQ, and found that greater computer use was indeed associated with higher psychological difficulty scores. They also reported that "Children who spent >2 hours per day watching television or using a computer were at increased risk of high levels of psychological difficulties" (p.1011). Importantly, screen use (which was the variable of Page et al.'s (2010) study) is wide and does not specify OCG, and I consider that the role of someone who is watching TV or even using a computer is more passive than playing OCG where the playing is more

interactive, and the player is more active in the game. However, I should emphasise that the presented correlations are observed only with OCG, but not with MC players, and are observed with TD children, but not children with ASD (Table 8.1).

However, contrary to this finding, Strittmatter et al. (2015) studied the differences in psychological well-being between gamers and non-gamers in 8,807 randomly selected European students. They inferred that gamers and non-gamers showed similarly increased risks for emotional symptoms, conduct disorder, hyperactivity/ inattention, self-injurious behaviours, and suicidal ideation and behaviours, but gamers were more likely to be male (similar to §7.5) and have a higher risk of peer problems than non-gamers (similar to TD-KSA, Table 8.1). However, non-gamers had a higher risk of depression than gamers. Regarding general screen-based use, Parkes et al. (2013) studied how time spent watching TV and playing electronic games at age 5 could predict changes in psychosocial adjustment for 7-year-olds using data from 11,014 children from the UK Millennium Cohort Study. The results showed that watching TV for 3 hours or more a day at 5 years can predict an increase in conduct problems by the age of 7. However, researchers stated that no association was found between screen time and emotional symptoms, hyperactivity/inattention, peer relationship problems or prosocial behaviour. Nevertheless, screen time is a general activity and does not specify computer games or MC.

Although this chapter found that a greater frequency of playing OCG is associated with higher peer relationship problems in the KSA sample, this was limited to TD children in KSA only because a different correlation was observed with the TD children in the UK sample (i.e., greater frequency of playing OCG was associated with higher prosocial behaviour scores) and is different to the outcomes of a study done by Strittmatter et al. (2015). These differences may be related to cultural factors (mentioned in § 7.8.2) However, this finding might be limited to TD children in KSA only, but we cannot support this hypothesis as no similar studies have been conducted in KSA in regard to studying the social-emotional and behavioural outcomes and the use of OCG or even screen-based tools. González-Bueso et al. (2018) systematically review the current literature to investigate the association

between Internet Gaming Disorder (IGD) and psychopathology, but with there being no studies included from Saudi Arabia or anywhere else in the Arab world, thereby representing a lack of research in this area. The research pointed out that only one study (Panagiotidi, 2017) had been conducted in the UK, where the researchers examined the association between problematic video game play (PVGP), video game usage, and attention deficit hyperactivity disorder (ADHD) traits in 205 healthy adults. The researcher reported a significant positive correlation between the Adult ADHD Self-Report Scale (ASRS) and the PVGP, specifically, with inattention symptoms and time spent playing games, but no relationship was found between the frequency and duration of play and ADHD traits. Therefore, it was not possible to thoroughly discuss these research outcomes with the previous literature as no study has been undertaken on gaming in KSA.

Our result of TD children's frequency of playing OCG in the UK (i.e., a higher frequency of playing OCG is associated with higher prosocial behaviour scores) has also been hypothesised by Durkin and Barber (2002), who stated that a moderate amount of online game playing is associated with positive social and behavioural outcomes in childhood and adolescence. Durkin et al. (2010) studied the relationships between computer-mediated communication (CMC) and the well-being of adolescents with and without specific language impairments. The researchers found no association between frequency of CMC use and emotional symptoms, anxiety and/or depression. They argue that the CMC environment can reduce some face to face cues that resulted in the positive adaptation of communication challenges for adolescents with specific language impairment. Although Durkin et al.'s study was mainly about CMC, OCG might provide children with an opportunity to communicate and socialise with others.

Altogether, it is essential to note that these correlations in the TD children in KSA (Table 8.1; i.e., higher frequency of playing OCG is associated with higher peer relationship problems) were not found with MC, which may indicate that MC is not less valuable than other games and no specific concerns were found in this research sample, although previous studies reported positive outcomes of cooperative games

(Bossavit & Parsons, 2018). An opposite outcome was found in the TD sample in the UK (Table 8.1; i.e., higher frequency of playing OCG is associated with higher prosocial behaviour scores). Previous studies reported positive outcomes of cooperative games with TD children. Dolgov et al. (2014) studied the effects of cooperative gaming on prosocial behaviours and found that cooperative gaming promotes prosocial behaviour and increased future spontaneous helping behaviours between players. Clark et al. (2015) noted that competitive single-player games (rather than cooperative games) were less effective in social and academic learning. Nevertheless, contrary to this result, another study shows no significant correlations: Lobel et al. (2017) reported that cooperative games (where players work together with others) were not associated with prosocial behaviour. However, in fact, they reported that competitive games were associated with decreases in prosocial behaviour, although only with children who played at a higher frequency (approximately 8 hours or more per week). Nevertheless, no significant correlation was observed between the number of hours (frequency of playing MC) and prosocial behaviour in this thesis. This correlation outcome was supported by Strittmatter et al. (2015), who inferred that gamers and non-gamers showed a similar risk for conduct problems (except for the TD children in the UK, as mentioned earlier, where higher frequency of playing OCG – but not MC – correlated with higher prosocial behaviour scores).

Overall, there are no positive or negative outcomes of playing MC (according to the SDQ scores) across all conditions in this research sample, indicating no specific concern for children's mental health. Therefore, the second hypothesis for this investigation was not supported enough so the null hypothesis cannot be rejected. In the next chapter, further research into the impact of playing MC with others (rather than alone) is presented in relation to the score of peer relationships problems, to go deeper into the role of MC in peer relationships.

8.6 Chapter Conclusion

Although the null hypothesis addressed in this chapter cannot be rejected, this chapter reported two outcomes. First, the frequency of playing OCG (excluding MC)

for TD children in KSA may have a negative impact, as a higher frequency of playing OCG is associated with higher peer relationship problems (Table 8.1), but this is not presented in MC nor in TD children in the UK. In fact, a higher frequency of playing OCG for TD children in the UK is associated with higher prosocial behaviour scores, which is considered to be a positive impact on children's mental health. These are almost opposing outcomes between the two countries, where the outcomes were positive for the UK sample but negative for that of KSA. Two possible hypotheses were offered regarding the cultural factors that may cause the differences in these two outcomes (described in § 7.8). Children may have been treated differently due to some of the parental management and familial structures, or it could be that parents have negative views of games due to some cultural and religious factors that result in the belief that these negative outcomes are caused by games (see the quotation of Jaswal & Akhtar, 2018, p.37 in § 7.8.1.2); however, neither of these two hypotheses can be approved as no similar studies have been conducted in KSA in regard to the use of OCG or even screen-based tools. Therefore, healthcare professionals and researchers interested in the effects of OCG in KSA need to investigate this issue in depth to understand these correlations (i.e., higher frequency of playing OCG is associated with higher peer relationship problems).

The second outcome of this chapter is that no significant correlation between the SDQ outcomes and the MC was found, although some previous research revealed that MC might be a useful place for children with ASD, as parents had reported feeling about Autcraft (Ringland et al., 2015, 2016a) (discussed in § 4.6), and reveal that MC provides children with a socializing space, which is important for their mental health development (Mazurek & Wenstrup, 2013). This was also supported by parents' statements (presented in §10.3). Importantly, it should be noted that no adverse social-emotional or behavioural impact of playing MC was observed for all children with ASD in both countries. These outcomes are significant because they can reassure parents, teachers and healthcare professionals that MC is not less valuable than other playful activity and does not have specific concerns for this research sample,

and might be a useful tool to be used for social interventions with children with ASD, which is discussed in the following chapter.

CHAPTER 9: ASSOCIATIONS OF PLAYING MC WITH OTHERS WITH PLAYERS' PEER RELATIONSHIP PROBLEMS SCORE

9.1 Introduction

This chapter presents and discusses the results in light of the third research question, whether there is an association between the frequency of playing MC with others and players' peer relationship problems score. In this section, data went from children's general social-emotional and behavioural outcomes to 'peer relationships' specifically and from playing MC to the score of 'playing MC with others. The data collection and analysing process is stated in § 5.3.3 and 5.5.1, and demographic information of the sample is presented in Chapter 6.

For this chapter's hypothesis, Spearman's rank correlation coefficient was used (Table 9.1) to test the correlation between peer relationship problems score and the frequency of playing MC with other scores. Correlations are run among each condition separately for comparison purposes, although it was not possible to include the HL sample due to the sample size (see thesis limitations, § 11.3). The differences in the mean score of peer relationship problems of the SDQ are presented (Figure 9.1) among groups of conditions and type of play. Higher scores of peer relationship problems mean abnormal outcomes (scoring was presented in § 5.3.3.1) for comparison purposes. Difference between the playing groups (the type of playing) and the peer relationship problems scores (measured by the SDQ) were tested using the Kruskal-Wallis test (described in § 5.5.1) (Table 9.3). To end by confirming the findings, multiple regressions are run to predict peer relationship problems scores (Table 9.2). After that, a comparison of the mean and standard deviation on parents' rating on the impact of MC on their children's friendship and peer relationship skills is presented (Figure 9.2 and Figure 9.3), and the Mann-Whitney U test (described in § 5.5.1) is run to test difference in the means of the two groups (MC single-player and MC multiplayer). Finally, the chapter concludes by reflecting on an overview of the main findings in light of the research questions.

9.2 Hypothesis Test

Similar to the previous hypothesis, several studies found that MC is helpful for players in the general population, and has improved their social skills, such as their sharing, collaboration and communication skills (e.g., Bebbington & Vellino, 2015; Davis et al., 2018; Choo et al., 2013; Cilauro, 2015; Hollett & Ehret, 2015; Rexhepi et al., 2018; Overby & Jones, 2015; Nebel et al., 2016; Voiskounsky et al., 2017; Willett, 2018), but this chapter emphasizes peer relationships and the score of the frequency of playing MC with others. This rationale has also been presented in-depth in § 1.2 and in Chapter 4. Therefore, this study hypothesises the following:

H_1 The score of playing MC with others is associated with the peer relationship problems score.

H_0 There is no association between the score of playing MC with others and the peer relationship problems score.

In this part, Spearman's rho correlations test was used (Table 9.1) to present the association of the peer relationship problems scores with playing MC with others (discussed in § 5.5.3 and § 7.3.4). The correlation matrix shows that a higher frequency of playing MC with others is significantly associated with lower peer relationship problems score in the ASD children in KSA (r_s =-.508, p< .05). However, the null hypothesis cannot be fully rejected, as not enough evidence to support the alternative hypothesis across all this study sample was presented.

Table 9.1: Spearman's rho correlations of playing MC with others and peer relationship problems score

Country			N	Peer relationships problems score
UK	ASD	Playing MC with others	47	-.199
	TD	Playing MC with others	32	-.056
KSA	ASD	Playing MC with others	17	**-.508***
	TD	Playing MC with others	28	-.098

* p<.05

9.3 Multiple Regression to Predict Peer Relationship Problems Score

Multiple regression is performed to predict the peer relationship problems score (presented in § 5.3.3.1) of a number of predictors (ID variables) to provide a more advanced exploration of the interrelationship among a set of significant variables, i.e. country (UK and KSA), conditions (ASD and TD), child's gender (boys and girls) and age, frequency of playing OCG, MC lifetime duration, MC frequency, playing MC with others in one model, as well as to make powerful and accurate predictions about the peer relationship problems score. This makes it ideal for the investigation of more complex real-life data.

The assumptions of the multiple regression provided support for the significance of the model. The linearity of the variables were assessed using a scatterplot to plot the predictor variables with the peer relationship problems score, and can also be observed in the figure which includes the regression standardized residuals against the predicted values (Appendix 4, §D). The residuals appear randomly scattered, which also is used to visually observe the homoscedasticity assumption that had been met. Independence of residuals was assessed using the Durban Watson Statistic of 2.145. Multicollinearity was not found within the model as tolerance values were greater than 0.1 (the lowest is 0.487), and no strong correlation was found between the independent variables. The studentised deleted variables did not have values greater than +3 standard deviations (-2.485, 2.243), and no leverage values were found to be greater than 0.2 (.01025, .11328), and no values of Cooks Distance were above 1 (.00000, .03363). This confirmed that the model had met the assumptions of normality.

The full model (full tables of SPSS output are placed in Appendix 4, §D) shows that these variables can significantly predict the score of peer relationship problems, $F(8, 223) = 9.447$, $p<.001$, $R2 = .226$; and explained 22.6% of the variance in the peer relationship problems score. However, Table 9.2 shows that only three variables made a significant contribution to the model: conditions predicted the peer relationship problems score ($\beta= -.45$, $p<.001$), as did the score of MC frequency ($\beta= .14$, $p=.05$), and the score of playing MC with others ($\beta= -.22$, $p<.01$).

Table 9.2: Multiple regression predicting peer relationship problems score

	B	S.E.	Beta	t	Sig.
Country	.372	.317	.072	1.176	.241
Conditions	-1.167	.155	-.450	-7.523	**.000**
Child's gender	.426	.419	.062	1.017	.310
Child's age	-.020	.087	-.014	-.232	.817
Frequency of playing OCG	.065	.148	.028	.438	.662
MC lifetime duration	.091	.107	.070	.852	.395
MC frequency	.339	.172	.141	1.971	**.050**
Playing MC with others	-.375	.141	-.220	-2.655	**.008**
(Constant)	5.963	1.253		4.758	.000

Dependent variable: Peer relationship problems

9.4 Differences in the Means of Peer Relationship Scores

While the regression analyses met the assumptions of parametric analysis in the previous section (§9.3), it considered only main effects, as a sub-group analysis would not meet parametric assumptions when the data are broken down into subgroups; and therefore, follow-up tests are reported next to further investigate the main effects of the research groups in this section. Figure 9.1 shows the differences in the means of peer relationship problems scores of SDQ among groups of conditions and types of play. Higher scores of peer relationship problems mean abnormal outcomes (scoring was presented in § 5.3.3.1). This chart is useful because it includes children who have not played MC for comparison purposes, although means of peer relationship problems scores for children with HL should be considered cautiously because of the sample size issue (discussed more in the thesis limitation section, § 11.3).

The Kruskal-Wallis test was run to test the differences between the playing groups (the type of playing) and the peer relationship problems scores. A Kruskal-Wallis H test (Table 9.3) showed no significant difference in the mean score of peer relationship problems for the UK sample among playing groups in the ASD sample, $\chi2(2, N= 62) = 1.004$, $p=.60$, nor in the TD sample, $\chi2(2, N= 59) = 4.365$, $p=.11$. In KSA,

there was also no significant difference in the mean score of peer relationship problems among playing groups in the ASD sample, $\chi 2(2, N= 54) = 5.144$, $p=.08$, nor in the TD sample, $\chi 2(2, N= 57) = 1.088$, $p=.58$. Therefore, the mean score of peer relationship problems was not different between the playing groups.

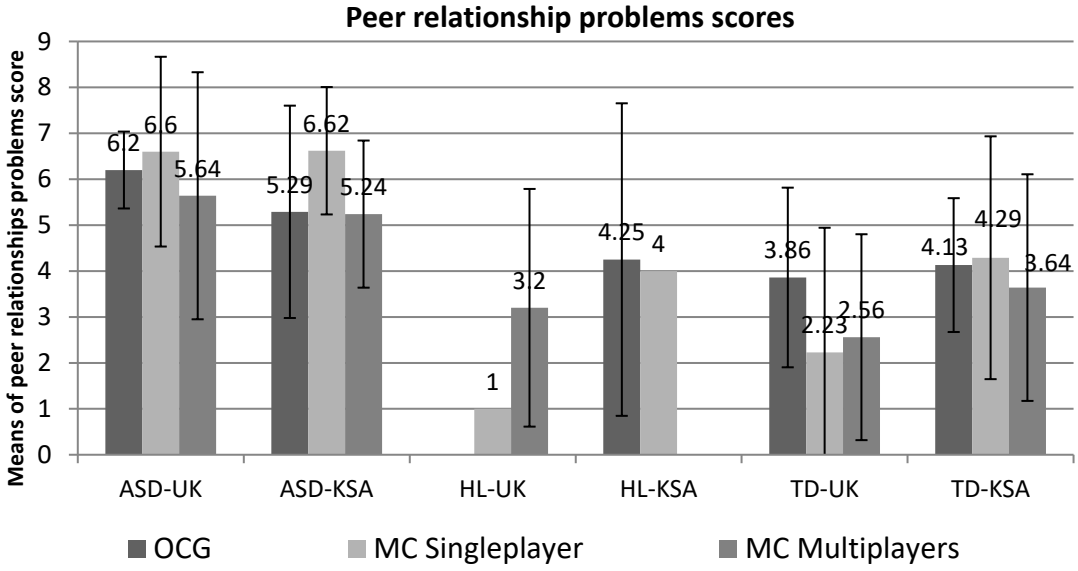


Figure 9.1: Differences in peer relationship problems scores

Table 9.3: Kruskal-Wallis ranks for peer relationship problems scores among the playing groups

Ranks of peer relationship problems scores and test statistics[a,b]

		Playing groups	N	Mean Rank	χ^2	Df	Sig.
UK	ASD	OCG	5	34.00			
		MC Single-player	10	36.15			
		MC Multiplayer	47	30.24			
		Total	62		1.004	2	.605
	TD	OCG	14	37.96			
		MC Single-player	13	25.31			
		MC Multiplayer	32	28.42			
		Total	59		4.365	2	.113
KSA	ASD	OCG	24	25.85			
		MC Single-player	13	35.81			

	MC Multiplayer	17	23.47			
	Total	54		5.144	2	.076
TD	OCG	15	31.23			
	MC Single-player	14	31.21			
	MC Multiplayer	28	26.70			
	Total	57		1.088	2	.580

a. Kruskal-Wallis test
b. Grouping variable: Playing groups

9.5 Impact of MC on Children's Friendships and Peer Relationships

Participants were asked to rate the impact of MC on the child's everyday life in friendships and peer relationships using a semantic differential scale, namely a scale of two polar adjectives (ranging from 5 = extremely positive to 1 = extremely negative, so a higher score means a more positive impact; discussed in depth in § 5.3.3.1). The mean scores of respondents' thoughts on the impact of MC on their child's friendship scores (Figure 9.2) and peer relationship scores (Figure 9.3) are given in comparison with the playing type; but, means scores for children with HL should be considered cautiously because of the sample size issue (discussed in § 11.3). In order to see whether there is a significant difference between the two playing groups (MC single-player and MC multiplayer) and the impact of MC on the children's friendships or peer relationship scores, the Mann-Whitney U test was run.

The test (Table 9.4) indicated higher positive rates for MC's impact on friendships were presented for children in the MC multiplayer group in the UK for the ASD (U= 147.5, p= .05) and TD (U= 117.5, p< .05) samples. However, these differences were not significant in KSA for the ASD (U= 81, p= .15) and TD (U=132, p= .06) samples.

In terms of the impact of MC on peer relationships, the Mann-Whitney test (Table 9.4) indicated higher positive rates for MC's impact on peer relationships were presented for children in the MC multiplayer group in the UK for the ASD (U= 126, p< .05) and TD (U=127, p< .05) samples. However, these differences were not significant in KSA for the ASD (U= 109, p= .94) and TD (U=161, p= .32) samples. Overall, MC has

a higher positive impact on friendships and peer relationships for players in the multiplayer groups than the other group for TD and ASD children in the UK sample.

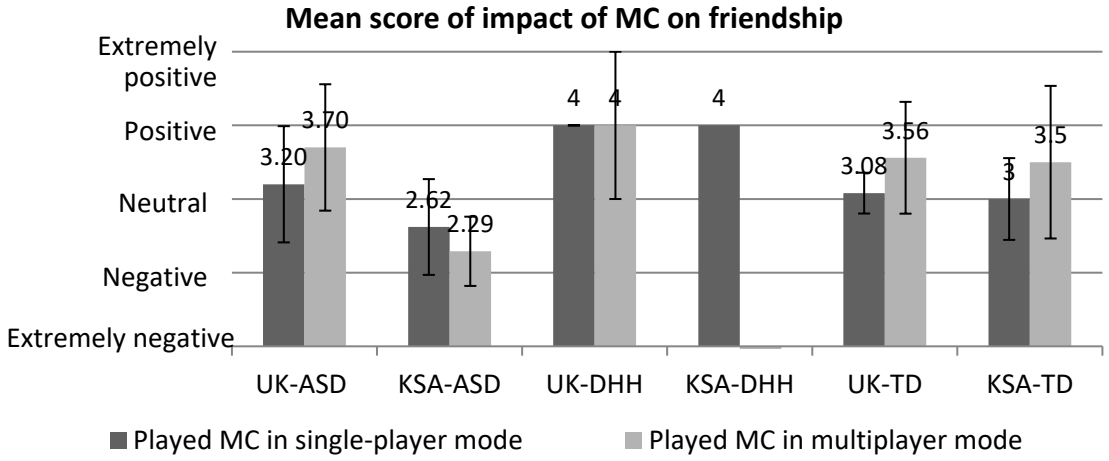


Figure 9.2: Mean score of the impact of MC on friendships

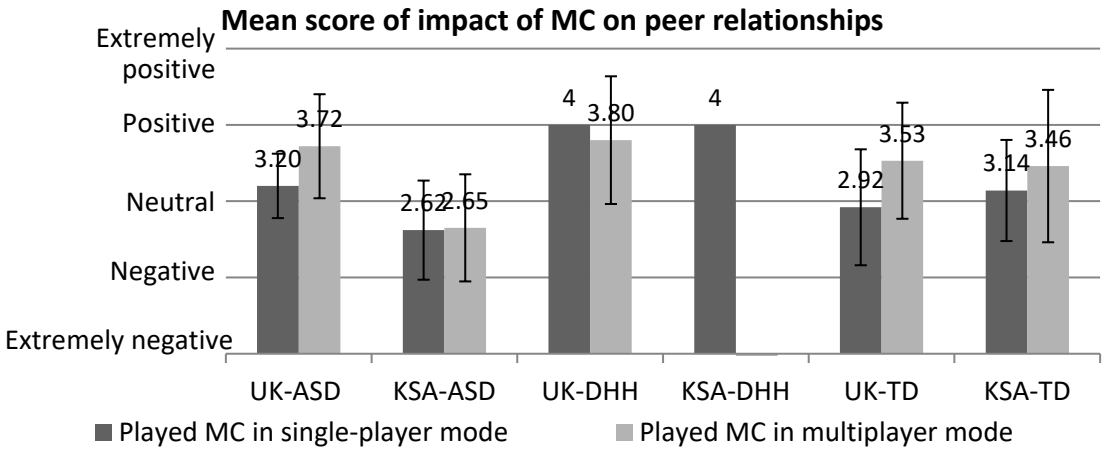


Figure 9.3: Mean score of the impact of MC on peer relationships

Table 9.4: Mann-Whitney ranks for the Impact of MC on friendships and peer relationships

Ranks and Test Statistics[a]								
		Impact on your child's everyday life on:		N	Mean rank	Sum of ranks	Mann-Whitney U	Sig.
UK	ASD	Friendships	Single-player	10	20.25	202.50		
			Multiplayer	47	30.86	1450.50		
			Total	57			147.500	**.050**
		Peer relationships	Single-player	10	18.10	181.00		
			Multiplayer	47	31.32	1472.00		
			Total	57			126.000	**.011**

	TD	Friendships	Single-player	13	16.04	208.50		
			Multiplayer	32	25.83	826.50		
			Total	45			117.500	**.012**
		Peer relationships	Single-player	13	16.77	218.00		
			Multiplayer	32	25.53	817.00		
			Total	45			127.000	**.026**
KSA	ASD	Friendships	Single-player	13	17.77	231.00		
			Multiplayer	17	13.76	234.00		
			Total	30			81.000	.150
		Peer relationships	Single-player	13	15.38	200.00		
			Multiplayer	17	15.59	265.00		
			Total	30			109.000	.945
	TD	Friendships	Single-player	14	16.93	237.00		
			Multiplayer	28	23.79	666.00		
			Total	42			132.000	.067
		Peer relationships	Single-player	14	19.00	266.00		
			Multiplayer	28	22.75	637.00		
			Total	42			161.000	.323

a. Grouping variable: Playing group

9.6 Discussion

This chapter seeks to answer the third research question of this study: whether there is an association between the frequency of playing MC with others and players' peer relationship problems score. The correlation matrix (Table 9.1) indicated a significant association, namely a higher frequency of playing MC with others is associated with lower peer relationship problems for children with ASD in KSA (r_s =-.508, p< .05). As no other correlation can be reported, the null hypothesis cannot be fully rejected, and not enough evidence was found to support the alternative hypothesis.

Although the result of the previous chapter found some great association of playing MC within the SDQ outcomes (i.e., longer MC lifetime duration for children with ASD was associated with lower total difficulties in the UK sample and with higher prosocial behaviour in the KSA sample) along with the analysis within this chapter (i.e., higher frequency of playing MC with others is associated with lower peer relationship problems for children with ASD in the KSA sample), these results contradict some of previous studies. For example, Cai and Nguyen (2018) studied the use of electronic gaming and social adjustment in early school-aged children and found no significant

associations between gaming frequency and peer relationship problems. However, the study of Cai and Nguyen did not focus on the variable (playing with others) but instead on games and playing in general. Lobel et al. (2017) demonstrated that gaming frequency was not associated with other changes in externalising problems or peer relationship problems. However, the samples of Cai and Nguyen (2018) and Lobel et al. (2017) were TD children in European countries and, therefore, the association of playing MC with others with peer relationship problems was only relevant for children with ASD in the KSA sample (which might be a results of cultural differences, presented in § 7.8). Alternatively, this positive outcome might be a result of playing with others that may have advanced players' social ties with other players, which was found to be highly connected to positive psychological well-being (Depping, Johanson, & Mandryk, 2018; Schneier & Taylor, 2018).

Interaction with others is an important aspect of playing MC with others. Although this study did not find significant associations between playing MC with others and peer relationship problems scores in the UK samples or the TD children in KSA (Table 9.1), the score of playing MC with others can significantly predict the peer relationship problems score (β= -.22, p<.01) (Table 9.2). Beside this, it was noted that a higher frequency of playing MC with others is associated with lower peer relationship problems for children with ASD in the KSA sample. These two outcomes can be clearly observed through parents' statements (presented in the next chapter).

Mu and Sin (2018) reported that using MC for students with ASD have developed their relationship with teachers and classmates and increased their communication and collaboration. Moreover, parents, in this thesis, thought that MC helps their children to develop their communication with their friends, particularly for children with ASD (reported in the next chapter), similar to what had been reported by Smolčec and Smolčec (2014), who found that MC helped children to develop collaboration skills and build friendships by having fun and learning how to work in groups and exchange ideas. Children without friends report higher rates of loneliness and lower social competence (Parker & Seal, 1996). Thus, it would be very important

to find ways to develop and facilitate these friendships and peer relationship skills through these types of games.

The result of this thesis indicated that parents of ASD and TD children in the UK from the MC multiplayer group rated the impact of playing MC on their children's friendships and peer relationship significantly more positively than parents of children in the MC single-player mode (Table 9.4). This higher positive rate in these regards has also been stated in other contexts of social life. For instance, children who enter elementary or primary schools with a friend reported higher academic satisfaction compared to children who started school without a friend (Rubin et al., 2015). A similar pattern of UK results was obtained by Cole and Griffiths (2007), who found that massively multiplayer online role-playing games (MMORPG) can be great social games that contributed well to players' relationships. Regardless of the type of game, about 40% of gamers play games with their friends (Entertainment Software Association, 2016). In addition, online games were found to be key in friendships for almost 91% of video gaming boys (Lenhart, 2015). It was also reported that games had resulted in improving relationships between students (Robertson & Miller, 2009). Furthermore, Clark et al. (2015) reported that single-player games were less effective in learning, but multiplayer sessions show significantly greater learning outcomes.

However, the difference in parents' rating of the impact on playing MC on their children's friendships and peer relationship between the playing groups was not significant in KSA (Table 9.4), which might be explained by cultural differences (discussed in § 7.8.2). Mashat et al. (2015) presented a number of cultural factors that may impact the Arabs' social communication and interaction. These factors include, but are not limited to, spoken language and Internet language, lifestyle system, gender and age differences, personal information, conservatism, and Internet access. These factors might explain the countries' differences in parents' rating on the impact of playing MC on children's friendships and peer relationships.

Although there were no significant differences between the two groups (MC single-player versus MC multiplayer) regarding how parents of children with ASD rated the impact of MC on children's friendships and peer relationships in KSA (Table 9.4), this

chapter concluded that higher frequency of playing MC with others is associated with lower peer relationship problems for children with ASD in the KSA sample (Table 9.1), which means better mental health (Goodman, 1997). The point here is that parents of children in the MC multiplayer mode did not rate the impact more positively even though the playing of MC with others is associated with better peer relationship. Although this point could be addressed by observing the mean of peer relationships problems score, there were no significant differences (Table 9.3). As a result, another possible explanation is similar to what has been made in § 7.8.1.2, that parents have negative views of games due to some cultural and religious factors that result in them considering there are no positive outcomes for games while, in fact, the outcomes of the SDQ shows a positive impact. But, no previous study has discussed these issues in the KSA area due to the lack of research on ASD and computer games. Therefore, further research should investigate how and why a higher frequency of playing MC with others is associated with lower peer relationship problems, as well as examining why this association was presented for children with ASD in the KSA sample.

As gender and age are important factors in developing a relationship (Hay et al., 2009), a discussion of these two factors might be useful. A previous study found that male students scored lower on social and emotional skills than female students (Polat, 2003). However, this study (Table 8.2 and Table 9.2) found that gender cannot predict the total difficulties scores (β= -.02, *p*=.75) nor the peer relationship problems scores (β= .06, *p*=.31), which might be due to the unbalanced ratio of boys and girls in this sample (though it is found that gender has a role in the selection of the type of playing, Table 7.3, and discussed in §7.8.3). Some previous reviews, such as the Scottish Government report (2015), stated that none of the reviewed studies examined the role of gender and age on the impact of OCG on learning. Nonetheless, the finding of this chapter is contrary to some recent studies, which have suggested that gender is associated with peer relationship problems. Cai and Nguyen (2018) studied the use of electronic gaming and social adjustment in early school-aged children and found that gender has a significant association, where boys play more

electronic games and show less prosocial behaviours and have more peer relationship problems than girls.

Likewise, this study (Table 8.2 and Table 9.2) found that age cannot predict the total difficulties scores (β= -.06, *p*=.31) nor the peer relationship problems score (β= -.01, *p*=.81) (similar to the outcome in Table 7.9). Contradictory to this thesis outcomes, previous studies noted that the age variable has a role in the outcomes. For example, Cai and Nguyen (2018) point out that younger children have less autonomy and higher parental mediation, which might have an impact on their selection of gaming activity. In this study, parents' mediation might have impacted on how the children interact with others, taking into consideration that almost half of the participants are children with special needs and require more parental mediation, as well as the fact that half of the participants are from a conservative society. Future studies on developing relationships with others through gaming are recommended to investigate the role of gender and age of players on peer relationship development.

9.7 Chapter Conclusion

The hypothesis test shows that a higher frequency of playing MC with others is associated with lower peer relationship problems only for children with ASD in KSA (Table 9.1). Thus, the null hypothesis cannot be rejected for the UK sample, and not enough evidence was found to support the alternative hypothesis.

Remarkably, parents of children who play the MC multiplayer mode in the UK are more likely to report the impact of MC on children's friendships and peer relationships positively than parents of children who play in single-player mode (Table 9.4), although no significant difference in the mean score of peer relationship problems was reported (Table 9.3). This could be explained by the parents perhaps having observed a higher positive impact for the multiplayer mode (as indicated; Table 9.4), but with their children still having some peer relationship problems. In other words, parents have observed the usefulness of MC, although this did not present changes in the mean score of peer relationship problems. This can be seen in previous studies (e.g., Smolčec & Smolčec, 2014; § 4.4.3.2) which reported that

parents thought that MC helps their children to develop their interacting with their friends, which would provide better mental health (Cole & Griffiths, 2007).

The interesting point is that higher frequency of playing MC with others is associated with lower peer relationship problems for ASD children in the KSA sample, though no differences in the impact of MC on friendships and peer relationships were observed among playing groups in that sample (Table 9.1 and Table 9.4). Parents of children in KSA may have negative views of games due to some cultural and religious factors that impact their rating of the MC outcomes (Mashat et al., 2015), but since no previous study has discussed these issues in respect of KSA, this cannot be confirmed, and should be addressed in future research. Hence, further research should investigate how and why a higher frequency of playing MC with others is associated with lower peer relationship problems in the ASD-KSA sample, as well as examining why this association was not presented for other groups in this research's samples. Overall, the outcomes of this chapter indicated that MC has some advantages to their peer relationship skills.

CHAPTER 10: QUALITATIVE DATA ANALYSIS & FINDINGS

10.1 Introduction

This research utilised the convergent mixed methods design (presented in § 5.3), where quantitative and qualitative data are collected together, but analysed separately, and with the results of one then used to confirm or disconfirm the other (Creswell & Creswell, 2018; Creswell & Clark, 2017). This chapter addresses the qualitative part of the research phenomena, seeking to understand the phenomenon of playing MC from the perspective of parents' and children's observations and interviews. It elaborates on the survey findings by interpreting and discussing the qualitative data generated by 85 statements provided by parents of all children (from both countries, and all conditions - with ASD, HL or TD), and the interviews, comprising four children interviews and three parent interviews. Template analysis is used for the parents' qualitative responses from the questionnaires, and raw statements and the details of each case are provided in Appendix 4, §A. For more information about the data analysis process refer to §5.5.2.

In this chapter, findings are discussed in three different sections corresponding to the survey findings. The first section further elaborates the extent of why children have shown interested in MC (§10.2), through dynamic experiences reported by parents. Reasons are related to three main features of MC: having the freedom to be creative and imaginative, offering a space for developing peer relationships and peer interactions, and being a world of entertainment and enjoyment. The second section goes into detail about the positive and negative outcomes of playing MC alone or with others (§10.3). It primarily explains three themes that emerged from the analysis, namely social outcomes (i.e., it creates social and communicative interaction opportunities with other people), emotional (i.e., being calm, happy and relaxed), and behaviour (i.e., practising of real-life situations and behavioural management). The third section involves the discussion of three concerns raised by parents that may contribute in shaping parents' and children's choices and decisions to engage in

playing MC as well as the outcomes of playing MC (§10.4): addiction, Internet safety, and reducing children's physical activities or movements. After that, the other statements that have not been discussed in the three main themes are presented (§10.5) to provide an overview of all the raw statements provided by parents in the questionnaire comment box. Then the children's observation and interviews are presented (§10.6) and followed by the parents' interviews (§10.7). Finally, the chapter concludes by summarising the overall qualitative data findings and reflecting on the implications of these with regard to the research questions (§10.8).

10.2 Main Reported Reasons for Being Interested in MC

Before introducing the reasons for playing MC, it can be noted that many children with ASD or HL show interest in MC according to their parents' statements. Reasons for being interested in MC can be related to three main reasons. It is a free and open space that allows them to create things that are imaginative as well as allowing them to interact with others – things that cannot be undertaken within the physical world – and that MC, therefore, is entertaining. Reporting such reasons may contribute to the development of the children' needs because children may become motivated to play MC to rehearse and improve their lacking in skills (Durkin, 2010; Durkin et al., 2013). Children's personal interest is a key element to be developed within the curriculum for best educational practice (Gunn & Delafield-Butt, 2016), and MC can be a tool for this. Additionally, it is possible to reconsider these features of MC (i.e., that capture the interest of children with ASD or HL) and implement it with other interventions to make learning more meaningful and useful.

Before presenting the reasons, it is essential to consider what parents thought about the game. Importantly, although it is recognized that what parents like may not represent their children's opinions and that parents' perspectives, it may be impacted by their observation of their child's emotions and behaviour. Parents of children with ASD in the UK expressed that their children love and enjoy MC, which can be observed in some statements, such as: "He loves it!" (4), "She's very excited about it" (26), "My child played a lot of Minecraft" (33), "It is one of the few things he enjoys in life" (42),

and “it seems to be the only thing where he can let loose and be himself without the peer pressure”(56). Parents of children with ASD in the UK also expressed their approval of the game, such as: “I approve of this game” (15), and “I find Minecraft educational and a good way of planning things” (16). Along these lines, a parent of a child with ASD from KSA reported similar statements, such as: “My child is autistic, he likes Minecraft” (70). A parent of TD children showed similar interest, stating that Minecraft is “a good game has no effect from my opinion” (79). Another parent of a TD child said “At the beginning he was so enthusiastic about the game that he pressed me a lot to buy three or four books about Minecraft, which is available in Jarir [a major bookstore in KSA], although he is too small to read them completely” (85). Some parents reported that they heard about MC from other families with children with ASD or from their children’s school; for instance, a parent of a child with ASD in the UK reported that the child “only knows what it is and it doesn't interest us as a family” (17). However, this parent did not state why MC does not interest them though they have heard other’s experiences. Therefore, it seems that parents of children with ASD who are interested in MC and approve of its impact outweigh other statements as presented above. Such statements ally with a previous study by Ringland et al. (2016a) who indicated that MC is a safe, powerful and interesting tool to children with ASD.

Parents of children with HL reported similar statements, showing that they are interested in MC. For instance, a parent of a child with HL from the UK reported, “I love Minecraft” (53). Another parent of a child with HL did not specify MC, with his statement being more general: “My child enjoys playing computer games” (54). Likewise, some parents of children with comorbidity of ASD and HL, for example, reporting that “My child absolutely loves this game and is very much motivated by it. [….] I still feel that Minecraft has helped his development too” (52).

Interestingly, and in comparison with parents of children with ASD or HL, only one parent of a TD child from the UK sample provided a positive statement that he believes “Minecraft is very educational for children […] I personally believe it is good for kids” (63). This was the opposite from most of the statements provided by parents

of TD children from the KSA sample, who reported, “I think this game is boring and useless. It teaches nothing to players” (80), and “Games make my child ADHD” (81). Therefore, there is a common theme among the statements of parents of children with ASD or HL that MC has a special attribute that makes it favourable, but this has not been reported by parents of TD children. Although the statements provided by the parents of children with ASD have not specified one consensus reason for MC being beneficial for children with ASD, the statements have, nonetheless, indicated parents’ approval for the game.

Some children may become interested in MC just as a form of discovering new games and experimenting with them, so their interest becomes temporary. For example, one parent stated that a child’s preference for MC might indeed be temporary. A parent of a child with ASD said:

> Still likes them very much, although can play for a while and then stop to do something else. Lately he has been asking for more apps that would allow him to make his own little films or cartoons on the computer or create his own games by simple coding (27).

Although this parent did not specify MC, the child is playing MC in multiplayer mode which may mean that they included the child playing MC into their statement about gaming. Another parent from the same group reported, “My child played a lot of Minecraft 18 months ago - but he now plays far less, probably only in school holidays. He has moved onto other games that he favours more than Minecraft” (33) and another stated “He played it more before discovering Survivalcraft” (15). Another parent of a TD child stated, “Doesn't play Minecraft as regularly. Terraria was another game that a lot of kids played for a time” (61), and another reported, “She would play it very often on her iPad, but now she has almost stopped playing it due to the new games she finds every now and then” (65). A parent of a child with comorbidity of ASD and HL reported, “[he] plays a lot of computer games of which Minecraft is just one” (50). Another parent of a TD child in the UK sample said, “I would say my son, like many kids his age, change games... he goes through phases of new games that come out. Just now it's constant FIFA...a while back it was constant Minecraft” (61).

Finally, it is worth looking at the reasons for MC being a game preferred by some children with ASD or HL in comparison with TD children. The findings are in accordance with the review of Durkin, Boyle, Hunter and Conti-Ramsden (2013). They found that video games (a term that has been used as an alternative of OCG, § 3.2) have implications for the special cognitive and educational needs of children with developmental and learning disabilities, and they remain an essential feature of their daily worlds. Durkin et al. (2010) found that children with language impairments are similar to their TD peers in using computer games and social media, although they have lower language and literacy abilities. Computer games involve a considerable amount of text, which requires players to read the text and decide things for themselves in developing the settings as part of the game, as well as communicating and interacting with other players. Overall, the multiplayer mode of MC was a preferred aspect of OCG for children with ASD and HL but was significant for children with ASD in the UK sample only (§ 7.2). Reasons for being interested in MC can be related to some main aspects that otherwise are limited within the physical world, which are giving them the freedom to be imaginative, creative and inventive; offering opportunities for social interaction; and presenting a space for entertainment.

10.2.1 Freedom for imagination and creativity

Having the freedom to do whatever they want to do in the game and offering free space to be imaginative and creative, is one of the main reasons why parents allow their children to play MC and why children become interested in it, and the most highlighted reason reported in this research. A parent of a child with ASD in the UK reported that the child "is hugely invested in these role plays, and they make her incredibly happy" (36). Furthermore, a number of participants expressed a desire to allow their children to play MC that is somehow related to imagination. Although it cannot be well defined what parents exactly meant by "imagination", it can be indicated that the general meaning of imagination is the ability to create and innovate things that are impalpable and are presented mentally. For example, a parent of a child with ASD in the UK thought that MC "allows them free imagination, very absorbing [and] safe" (8). Another stated, "It allows my child to be creative/build

structures. He struggles with this in real life due to physical limitations (co-ordination difficulties/ poor manual dexterity)" (22). A parent of a TD child in the UK also stated that "It helps them to exercise their imagination" (60). Moreover, a parent with a child with comorbidity of ASD and HL stated, "He also uses his imagination more in that he often thinks about the world he has built" (51). Thus, these comments illustrate that MC can be an imaginative tool for some children.

MC was also thought to be a creative tool by some of the respondents, where players can construct new things in the virtual worlds. Moffat et al. (2017) investigated the impact of three different games on creativity and found that MC can be used to engage students with a more creative state of mind. This was clearly observable through parents' statements in this research. For example, a parent of a TD child from the UK stated that they were "often very surprised at the skills involved to build most things my son manages [,] it is really impressive" (57). Another parent of a child with ASD in the UK said, "He pays attention to the construction of simple objects" (5), and "It helps with concentration and creativity" (23). Furthermore, a parent of a child with ASD in the KSA sample stated, "he likes the game of Minecraft to build air-planes with different designs, and he is creative in it, and I am happy for that" (70). Thus, it can be concluded that MC is preferred because it is endless and helps players to feel they are undertaking something that is like reality. This was similar to the reasons mentioned in previous studies (e. g., Sáez-López et al., 2015; Petry, 2018; discussed in the following paragraph).

Sáez-López et al. (2015) reported that 96.6% of their participants thought MC enables the discovery of new things, and 96.1% said it enhances creativity. Furthermore, Petry (2018) stated that children emphasised the freedom of being able to create whatever they wanted (the open space idea) as the main reason for continuing playing MC. Also, Nebel et al. (2017a) found that, although MC offers players more opportunities for creativity, some players lose attention easily and do their own gaming because of this open and endless world, which may delay the process of the given task. This shortcoming could be overcome by developing a good learning plan where players can be creative within a set of options and rules. Although "there is

some freedom for children [in the educational placement] to make decisions, their agency is somewhat limited because adults plan everything about preschool for children" (Arnott, 2018, p.963), which can be expanded through the use of games, such as MC.

To summarise, MC is played for many reasons and, in this section, it can be concluded that children prefer MC because it gives them the freedom to be imaginative, creative and inventive that otherwise is limited within the physical world. This is very important to children's social learning, especially children with special needs for its advantages which may meet their needs, such as rehearsing real-life scenarios and practising enjoyable interests.

10.2.2 Peer relationships and peer support

Another main reason for children (and mainly ASD children) being interested in MC is that it offers a space for social interaction with peers (the rest of related statements are reported in § 10.3, as social outcomes of playing with others). For instance, a parent of a child with ASD in the UK sample reported that the child "has lots of friends online, including other children with ASD & the peer support she gets for feeling 'different' is huge" (36). In addition, a parent of a child with ASD in the UK sample reported "My son has only recently become interested in Minecraft. It provides him with a common interest with his peers" (34). Moreover, another parent from the same sample stated, "She told me that roleplays on MC are like a book that you write with other people as you go along. She also has a friend who corrects her spelling and punctuation, so she assured me that she is learning more from MC than she would in school where her sensory processing difficulties and atrocious working memory make it very difficult to take in and retain information" (36).

A parent of a child with ASD from the KSA sample stated, "There are many other factors contributing to the attachment of children to this game, Minecraft, such as accessing the internet easily with the carries devices that have the game. He has a bigger brother than him, and he helps him to be attracted to the game" (68). On the other hand, a parent of a child with ASD in the UK sample stated that construction is

not their child's interest as they stated, "playing with his brothers consists of inventing and talking through Terraria-type scenarios [Terraria is similar to a sandbox game, though much more structured], rather than 'playing' as most children practice it" (48). This statement shows that the child likes the games because it is social interaction, which is similar to what MC has, though MC is more open. Finally, one of the main reasons for being interested in MC for children with ASD is that it has allowed them to socially interact with peers (for review, see §0). This is similar to what is reported by Sáez-López et al. (2015), who found that 96.6% of their participants thought MC enables rich interactions, and by Ringland (2019) that playing with other children in the physical world might be uncomfortable or even painful for some children with ASD; therefore, social interaction through MC was an alternative.

10.2.3 Entertainment

MC is an entertaining game in nature, as it was designed for fun. Some parents and children in this study reported that they are interested in MC because it is a fun and entertaining game (more of these statements is reported in § 10.3.4, in respect of the emotional outcomes of playing MC). For instance, a parent of a TD child in the KSA stated, "Minecraft is entertaining" (76), and another parent of a child with ASD in the UK stated that the child "really enjoys it" (20). A similar reason was reported by a parent of a child with ASD in the UK sample, stating, "She told me that role-plays on MC are like a book that you write with other people as you go along". Sáez-López et al. (2015) reported that their participants thought MC was fun (98.5 %). Moreover, Caroux et al. (2015) reported that online multiplayer gamers (like MC) were driven mostly by social enjoyment, and that games have an impact on players' experiences depending on the type of game and whether it is competitive or collaborative, players' immersion and emotion, and level of motivation and social interaction. Digital games, in general, were found to be helpful and increase students' motivation, as well as promoting positive attitudes toward schools and learning (Robertson & Miller, 2009). Therefore, MC is an entertaining game and many children like it because it is fun and offer a space for pleasure.

10.2.4 Summary

Overall, reasons can be summarised into three main aspects: having the freedom to be creative and imaginative, offering a space for developing peer relationships and peer interactions, and being a world of entertainment and enjoyment. All these reasons are important for all children, especially children with ASD, who see, hear and feel the world differently. Children may become interested to play MC to improve on their lack of skills (Durkin, 2010; Durkin et al., 2013). A parent of a child with ASD in the UK reported, "[the child] functions better in the virtual world than he does in the real world. Gaming is the most important thing in his life" (12). Similar statements are presented in § 10.3. Importantly, parents, teachers and others who are interested in gaming are interested in understanding the role of games in children's mental health, and which we are trying to achieve in this study. A parent of a TD child in KSA stated:

> I do not have knowledge of the game, its benefits and its harm. I am surprised that children of his age are very intrigued by it, and I fear that it will be harmful to him in the distant future. As an example, causing distraction or causing him epilepsy or addiction. I am not an expert, but I am almost sure that this game is a secret and I hope to know whether it is really suitable for him or not (83).

Thus, understanding the impact of MC on the social-emotional and behavioural outcomes of children is needed, which was quantitatively uncovered in the previous two chapters. Understanding children's needs are vital to managing their own involvement in their own meaningful learning (Arnott, 2018). Therefore, it is important to identify why children like MC and then consider the features (that made MC an interesting game) and use them for future social interventions, especially intervention that aims to provide children with ASD a common interest and an enjoyable and meaningful place for learning.

10.3 Social-Emotional and Behavioural Outcomes of MC

In this section, the findings of the qualitative data related to positive social outcomes of playing MC are presented in the light of the main aspects: interacting and communicating with others as well as the willingness to play with others. Parents and children also have stated some outcomes of playing MC that are related to their social and emotional feeling as well as behavioural management.

10.3.1 Interaction with others

Respondents comment that MC offers an opportunity for fostering communication with family and friends and developing relationships. For example, some parents of children with ASD in the UK sample reported that MC had helped the children to engage with each other and with other people, stating: "[He] plays alongside a friend who is on the other end of FaceTime, so they chat about what they are doing when in the same world" (24); "Without it, she would be socially isolated and online there is always someone to play with" (1); "I play it with him and so does his sister. It has helped with all areas of his life" (18); "She created a whole world based on her other obsession. […] Her friends have helped her, she gets an enormous sense of achievement from this" (36); "He interacts online with the same small group of players. [He] is very engaged in what he is doing, and has learned a lot about cooperation, turn taking, teamwork and strategy. As he is now home educated due to difficulties in mainstream schooling, this is his only source of interaction, chat and laughter with peers" (13); "[He] has developed a few friends from school through playing Minecraft but this seems to go in fits and starts" (9). All previously mentioned statements of parents show some indication that MC has helped their children to develop social and relationship skills with others, and provides them with an opportunity to socialise with each other through playing with each other or through having a conversational discussion about the game (similar to the outcomes of Kuhn & Stevens, 2017, mentioned earlier). Interacting with others, including playing with parents, is important to the children's mental health (presented in § 2.5.1). Through play, children learn how to interact with peers as well as how to communicate or

share something, which are all significant parts of socialisation (Zastrow & Kirst-Ashman, 2010).

Another example was seen from one of the observed children, who reported that she had played MC not only with her friends but also with her family members. She reported that the game had developed their relationship with each other as well as gave them opportunities to practise their communication and negotiation skills. Dezuanni et al. (2015) reported a similar conclusion that playing MC in a server together with others showed many forms of social interaction, such as discussing, sharing, arguing, ignoring and debating. Participants share pictures and stories of their gaming and share problem-solving skills with each other, as well as presenting positive thoughts about the shared MC server because of the social interaction. Marcon and Faulkner (2016) used MC as a pedagogical tool and found that it provided learners with an engaging, collaborative environment, which allowed them to express their interest and gaming activities within their online social tools and indicated more engaging social learning beyond the classroom.

Ability to communicate and collaborate with other players, which is clearly observable in the previously presented parents' statements, is critical to social interaction and developing relationships (Cambron, Catalano & Hawkins, 2019; Kuhn & Stevens, 2017; Southgate et al., 2018). Unambiguously, Parsons (2015) argued that collaborative virtual environments afford a learning context and opportunities for social communication for children with ASD. Rexhepi et al. (2018) concluded that MC allows children to express their ideas and share them in the virtual world via collaborative teamwork. Also, Hong-An (2016) found that MC discussion threads could be a self-directed learning tool and educational and motivational support for other players, as well as a starting point for socialisation.

MC has helped children to interact with friends and participants, be a connection point with friends and a source for the achievements that the players gain by playing with others. This was also true for a child with comorbidity of ASD and HL in the UK sample, where the parent reported that "I have also noticed that he is significantly more social since playing Minecraft, especially with other children" (52); and "He is

quite an expert and an authority with his younger brother. He will even play computer games with his sister. In the field of gaming [he] is an expert. It is the one area of social involvement where he is an expert" (50). Also, a parent of a child with HL from the UK also reported, "it has helped my daughter. It is a very good game, not just a craft game. It involves the family, and we play together to build a rollercoaster or fun fair or houses or castles. We talk through the plan together. It is an amazing game" (53). Further, a parent of a TD child in the KSA stated, "she plays only with her cousin and her special friends, which means people whom she and I know, and this is positive and will maintain her behaviour and morals" (77). Therefore, it is possible to say that MC has some social elements that make it useful for relationship and communication skills for some children with ASD, HL or the two conditions together. All previous quotations indicate that children's playing of MC with others provided them with opportunities to interact with others socially.

With regard to the social interaction through MC, Quiring (2015) concluded that MC is considered a virtual world, where players are respected through their avatars. The researcher discussed MC in various aspects such as the following: players have the ability to alter their virtual environment; there is no practical limitation to the size of the world, and players can come together in MC's space to participate in shared projects and events as a form of collaboration. All these social factors are significant advantages and have been emphasized by parents.

However, interacting with others during the game does not mean always reducing social conflict. A parent of a child with ASD in the UK stated that MC "can lead to arguments, e.g., if multiplayer and the players start destroying each other's worlds, and was more of an issue when younger in age" (3). Dezuanni et al. (2015) reported that children in their research enjoyed the game socially except one player due to not knowing some people on the server. However, although all these conflicts appeared to be inconvenient, it is part of the reality of life where conflicts are experienced in many situations and places but hopefully can be minimised and reduced.

10.3.2 Communicating with others

Healthy relationships are certainly built on communication, as it plays a fundamental role in social life and all stages of interpersonal relations and overcomes any gap between individuals (Mather & Robinson, 2016). MC seems to be very useful in helping children to communicate with other players, especially for children with ASD or HL. For example, a parent of a child with ASD in the UK indicated that the child "has been introduced to Minecraft through school, where he plays once a week, especially with his maths and science teacher, seems very chatty about it but hasn't asked to play at home" (6). This statement indicated that the child is "very chatty about it", providing the child with social and communication ways with which to talk to the parents about their gaming interests and experience. Further, a parent of a child with comorbidity of ASD and HL stated, "it is a good conversation opener, and he likes to talk to other children who are keen on this game, about Minecraft" (52). Another parent stated that her daughter "is much more able to communicate through the PC as it allows her time to form a response and check to see if her response is appropriate. She is more comfortable in the online world" (2). Previous studies also show some of these benefits in their examination of MC (Niemeyer & Gerber, 2015; Mather & Robinson, 2016; Hong-An, 2016; Swier, 2014). For example, Swier (2014) concluded that MC appears to be a useful platform for developing communication and negotiation skills and tasks for language learners. Niemeyer and Gerber (2015) found that all analysed YouTube videos had creators and viewers engaged in lengthy discussions, such as exchanging questions about the tasks, as well as exchanging feedback. Further, Hong-An (2016) analysed some discussion threads about MC and stated that it could offer cultural and social gaming exchanges as players have exchanged news, legal and technical changes to enable accessing the game as well as sharing a narrative or visual experiences of MC.

. Therefore, it is assumed that children with ASD have many social difficulties due to the lack of understanding and interpreting the social cues, which can be limited through the games. A parent of a child with ASD in the UK indicated, "She struggles with social interactions and the complexity of conversations, and she really can't read

faces or tone of voice so messaging levels the playing field" (1). Thus, MC can be used as a tool that makes the social interaction meaningful for children with ASD.

Sharing experiences with others is essential, as previous studies show that children like to share and discuss their gaming stories, including their play, and participate in peer discourse (Durkin, 2006), and this social interaction and sharing is vital for their cognitive and linguistic development (Cambron et al., 2019; Delafield-Butt & Trevarthen, 2015; Dezuanni et al., 2015; Durkin, 1995). Further, OCG is fundamental to peer socialisation for most children today (Durkin & Barber, 2002), especially for children with special needs (Durkin et al., 2013), as it can compensate the social deficits. The parent of a child with ASD in this study stated, "I think playing the 'creative mode' has helped my son to explain his ideas and negotiate meaning with others - useful pragmatics skills" (19). Another parent of a child with ASD stated, "It's certainly bridged the conversational gap between ASCs and NTs in many situations; i.e. the autistic thing seems to be popular with the mainstream, and that makes ASC expertise on the matter more valuable than in the days when AS kids did LARPing and Dungeons & Dragons - and got beaten up for it" (43). Therefore, MC can be helpful to children with special needs as it can reduce the social gap created by the disruption in social development as a result of their disability.

As noted previously, MC can be a tool for developing communication, not only by playing with others but also through finding and discovering a shared interest, a topic that allows players to communicate with each other and share their stories. A parent of a child with ASD in the UK sample stated that his child

> likes seeing things materialise on the screen that he has 'created' and also explaining to others how he did things and asking questions about their designs greatly enjoys talking about Minecraft with his school friends - this gives him common ground with them and enables him to discuss a subject that is relevant to other players (otherwise he focuses conversation on unusual topics/obsessions which alienates him from more general conversations and leaves friends with no response to give to keep a conversation going) (19).

Alongside these statements, another parent of a child with ASD in the UK sample declared that his child "plays with his younger brother, it has helped them to bond, and improved his ability to share" (40). Therefore, it is important to remember that many children with ASD have one or more intense interests, and they may repeatedly talk about it or practise it more often than usual. Parents and teachers are always advised to be flexible about this special interest and to ask their children to express and share their interest with others, except if this interest is restricting another child's freedom or causing problems. Therefore, and in order to be able to share their interest properly, communicating with others by playing MC or other games is essential. Petry (2018) also reported that children stated that MC helped them to collaborate with others, engage in discussions and share knowledge through learning or in teaching siblings and friends how to make things in MC. Thus, sharing playing experience with others and communicating with others are an important aspect of social learning that can be achievable for children with ASD, who play MC to create a bridge between them and TD children and create a friendlier learning environment.

10.3.3 Willingness to play with others

Some parents have children who have not played with others, but they are willing to allow their children to play with others with some limitations. This indicates that they may be aware of the social advantage of playing MC with others, such as a statement by a parent of a child with ASD in the UK stating, "I have heard about the benefits to autistic children and do not have a problem with limited play with friends from school but not strangers" (17). For example, some parents of children with ASD in the UK sample commented, "Would prefer to play with someone online who is cooperating with him" (5), and "She used to play PE on the iPad, mostly alone and world-creating. She has only recently gone on a server and started playing with other autistic children" (26). However, a parent of a child with ASD (34) stated that his child "will play Minecraft in turns with a child who comes over once a week", but this parent also reported, "They do not play online together", as the child "is not very interested in playing against other children online" (34). Thus, this had become a social activity

that is hoped to be helpful for children with ASD, although the child was playing the game in turn with others rather than playing with others at the same time.

10.3.4 Emotional outcomes of games

Parents' statements indicate that playing MC with others provided children with positive emotional outcomes, and this can be clearly observed in the stated reasons for playing MC (§ 10.2). For example, a parent of a child with ASD in the UK sample stated that his child "is always relaxed and happy when playing. He created amazing structures often for other people and linked to their likes and dislikes" (21). Other examples of parents' of children with ASD in the UK statements were clearly observable, such as "This environment, outside of being at home, is where [she] feels most confident and happy" (29), and "I hear her laughing often whilst playing with one particular friend who is also on the spectrum" (20).

Similar statements are also reported by a parent from another condition group, as one parent of a TD child in the UK sample stated, "It keeps my daughter calm and content" (55). Another parent of a TD child in the KSA sample said, "The game looks nice, and I saw that it helps my daughter to calm down and control her feelings" (77). Moreover, a parent of a child with comorbidity of ASD and HL stated, "That helps build his confidence as he is an expert" (50). Alternatively, a parent of a child with ASD from the UK sample pointed out some possible adverse outcomes, stating, "My son will only play in 'creative' mode as 'survival' he admits too stressful. The idea of other players ruining what he's built makes him very anxious" (45). This may be related to an individual case where it should be highlighted that ASD is a spectrum and what works for one child may not work for all children in the condition, which is also a principle of the philosophy of pragmatism (§5.2). For children with special needs in general, Durkin et al. (2010) found that computer games and media are more pleasant for children with language impairments than face to face interactions, as the impacts of negative nonverbal judgment or appraisal are less notable in the online context, and Ringland (2019) reported similar outcomes for children with ASD. Therefore, it appears that MC has an advantage for children's emotions and feelings

that it makes them happy and enjoy the social interaction with others (Kuhn & Stevens, 2017), and this positive social interaction experience is significant to their social learning (Baek & Touati, 2017; Cambron et al., 2019; Dezuanni et al., 2015).

Although this research did not find a statistical difference in the mean score of the total difficulties scores among playing groups in the UK sample (Table 8.3), nor in the KSA sample (Table 8.4), participants express some emotional concerns that may appear when children are playing or when they are asked to stop playing. For example, a parent of a TD child in the UK sample stated, “When I stop him playing to eat or do something, he rejects, and sometimes he cries” (66). A parent of a TD child from the KSA sample stated, “If I stop them playing the game they often misbehave and express bad feelings and show negative reactions” (84). Other parents of children with ASD from the UK sample commented about MC, “… can get upset if things go wrong, then has to be removed from the laptop” (39), and “Used to get upset if something went wrong with his Minecraft 'world', but now doesn't seem bothered and just builds another one” (30). Furthermore, another parent from the same sample reported, “As parents, we are happy that he isn't obsessed and spending too much time playing as he can get a bit irritable when playing if the game doesn't go his way” (9). A similar concern was identified in a previous study. Nebel et al. (2017b) reported that participants showed anger, displeasure or confusion after finding out that they could not reach their goal in MC. Moreover, a parent of a child with ASD reported, “[she] is as anxious playing computer games as she is in daily life. She is worried about misunderstanding rules, not completing game tasks on time, not completing tasks she has set herself” (44). This may explain the reasons why the game seems to be an anxious activity for some children, as some children with ASD have difficulties in understanding unexpected events and changing in routines (Baron-Cohen & Bolton, 1993; Iadarola et al., 2019; refer to §1.1.1 for more information about ASD), so this reaction seems to be rated to autism traits rather than the game itself.

Playing with others may cause emotional discomfort for some children. A parent of a TD child from the KSA sample reported another social concern stating, “Sometimes

she raises her pressure especially when she plays with someone who sabotages her things or deals with her negatively or aggressively" (77). In addition, some parents express concern about MC and their children's feelings and reactions. For example, a parent of a child with ASD from the UK sample stated, "The game is immersive and occupies her brain. After playing she is more likely to be explosive, and it can take some time to reacclimatise her to non-screen-based activities" (47). A parent of a TD child in the KSA sample reported, "The game causes him a distraction and strong nervousness. I have noticed that he has been jumping all the time involuntarily" (74). Another parent of a TD child in the KSA stated,

> Kids who are addicted to PlayStation are terrified and nervous when they want to go to sleep, even with parents. This has to do with the fast visual images displayed through the PlayStation games. Once I turn off the PlayStation during the study time, violent resistance occurs (which reminded me of addicts' clips because he starts hitting the wall), and then he calms down later on (75).

Therefore, some parents have expressed concern regarding the impact of MC on their children's mental health, although no medical concerns were reported by parents for this impact. Overall, in our data, there was some concern reported by some parents regarding how their children react when they are playing or when they are asked to stop playing. This was observable from parents of children with ASD, which may indicate a need for modification. Nevertheless, no concern about Autcraft was reported (this does not mean that Autcraft raises no concerns, but it may indicate so), so these limitations may have been reduced in Autcraft, as it was designed for this purpose (discussed in §4.6. However, almost all emotional discomfort and concern reported in this section can be managed even for children with ASD, by following adjustment interventions that are dealing with change in routine and overcoming unexpected events (Ruppert, 2018), which is part of day-to-day life.

10.3.5 Behavioural outcomes of games

Similarly to some of the statements provided by parents with children with ASD that MC gave them the freedom to socialise with others, some parents thought MC helped

them practise real-life situations. For instance, a parent of a child with ASD in the UK sample stated, “She uses Minecraft to work out what to do in situations that she struggles with” (46). Another parent of a child with ASD also reported, “There is a superficiality about the exchanges that she finds easier to deal with” and “although initially, she had meltdowns around policing screen time, as she has got older she has experienced more shutdowns, and Minecraft seems to keep her from totally disconnecting and is hugely useful to reduce sensory input” (1). In addition, a parent with a child with comorbidity of ASD and HL stated, “His behaviour and attitude has seemed to improve since discovering and becoming obsessed with Minecraft” (51). Therefore, MC seems to provide some children with ASD with an opportunity to exercise and practise real-life circumstances that will help them navigate future events (Ringland, 2019).

Some parents reported that MC was helpful for behavioural management. Just as the science of behaviourism has discussed the use of reinforcement in many theories, and how reinforcement can be used to identify and achieve the desired goal, some parents reported that MC has an impact on managing their children’s behaviours, such as through reinforcement. A parent of a child with ASD in the UK sample stated that MC is “Used in my sons’ specialist ASD School for challenging behaviour” (7). One parent of a player with comorbidity of ASD and HL from the UK sample reported that “A year ago he was still having aggressive meltdowns where he would be violent to adults and other children, and he doesn't do this anymore” (52). Another parent of a child with comorbidity of ASD and HL stated that MC is “a useful parenting tool that can be used to motivate him or produce desirable behaviour by using it as a reward or threat of removal/actual removal as a consequence of undesirable behaviour, as it is the one thing he really cares about” (51). Furthermore, a parent of a TD child from the KSA sample stated, “I use the game with the child as reinforcement in most cases” (83). These statements can indicate that MC is a game that can be used for reinforcement and used as a way to manage unfavourable behaviours.

Moreover, some parents may use the game to help their children with ASD to learn and develop their coping skills to adjust to changes in routine. It can also be used to

control sensory overload, as a parent of a child with ASD in the UK stated, “It's been such a boon. When she is in shutdown, it’s really helpful for her as a means of tuning out other sensory experiences” (1). In addition, a parent of a child with comorbidity of ASD and HL from the UK sample indicated,

> The other way that Minecraft has helped is that it is also a tool for behaviour management. It is something that he is obsessed about, and consequently, as a parent, I can use this to incentivise good behaviour or to implement a consequence of bad behaviour. For example, a sanction that is really effective is to take away his tablet so that he cannot play Minecraft for breaches of what we have agreed is acceptable behaviour. It also acts as a warning, so that if he is being non-compliant, I can warn him that if I have to ask him to do something again, the tablet is going to be taken away. This is usually very effective, and consequently, the more habitual compliance with adult demands he becomes, the easier he finds it to do, sort of in a virtuous circle (52).

Some parents may allow their children to play MC because they think it is somehow safer than going out with others, which was supported by one of the MC single-mode players. For example, a parent of a child from the KSA stated, “[….] and helped them stay at home in front of us” (73). It seems that the respondent thought this was an advantage as they can observe how the child plays and with whom the child plays. Overall, these parents may think MC is a good game because they can monitor their children’s play in the home and in front of them. Although this feature is available in many games, the simplicity of MC might make the difference.

On the other hand, some parents express some concerns that are related to behavioural outcomes of playing MC. For example, a parent of a child with ASD in the UK sample reported, “He struggles with social perception, e.g. in a PvP scenario if he loses he often perceives the other had an unfair advantage or assistance from others and tended to exhibit unkind behaviours almost in the apprehension of being unable to cope with social demands” (14). These “unkind behaviours” were also reported by some parents alongside the emotional discomfort, but I believe this is normal,

especially to children with ASD, as it is hard for some of them to process changes in routine and survive unexpected events (Gates, 2019).

I argue that these concerns could be managed by following adjustment guidelines to more easily cope with routine changes and overcoming unanticipated events, so MC might be a good opportunity to teach children how to overcome these issues. According to behaviourist philosophy, teaching should emphasise exercises as a means of increasing desired behaviours, and progress learning through changes in behaviours (Groff et al., 2010; Mitgutsch, 2008); thus, MC was used by some parents to increase desired behaviours. As such, children voluntarily respond to the parents' behavioural management based on the expected consequences that reward them with tokens for correct responses, (Wardlow, 2014), such as playing MC.

10.3.6 Summary

To conclude this section, based on parents' statements, it can be noted that there are three benefits of playing MC - social outcomes (i.e., it creates social interaction opportunities with other people), emotional (i.e., being happy) and behaviour (i.e., being calm or relaxed and as a rewarding for desirable behaviours). These outcomes are not fixed for all children, but they seem to be more common for children with special needs, such as ASD or HL as presented previously. Some of the disadvantages were presented as well, such as causing stresses, conflict with other players, and being unable to cope with social demands. I argue that these concerns or 'disadvantages' can be managed and treated similarly to similar concerns outside the online playing environment. A parent of a child with ASD who reported many emotional concerns stated,

> She is more able to work out solutions because of the set parameters and because there is no outside influence (i.e., once she learns the rules do not change) and she has learned to set herself reasonable targets, which has also transferred into target setting in daily life. I think we are lucky in that she has no problem disengaging from gameplay, but this is because she is ultra

compliant. She thrives within a rigid framework, and this applies to her playing games too (44).

This game can be helpful in involving children with ASD with social life and provide them with a better mental health world, similarly to what has been reported by this parent. For example, a parent of a child with ASD in the UK stated, “I cannot stress enough the positive effect Minecraft has had on her mental health on her dark days” (1). However, taking concerns alone without considering other variables may stop parents from allowing their children to experience and experiment with the idea of playing MC with others who may share a common interest or share a relationship, which will limit the social advantage of the game. In regards to the previous parental statement, this thesis has stated that MC might be a safe game for social intervention; indeed, it might be an excellent tool for children with ASD because it is objective, has fixed rules, dissimilar to humans where many circumstances impact how they feel and behave, which becomes hard to navigate for children with ASD (for more, see § 2.4.3).

In this section, there are three main impacts on children’s social learning and mental health, which are related to social-emotional and behavioural outcomes. As the social outcomes of the game seem to be the most important one as this thesis focuses on the relationship skills, it was divided into three sections - the ability to interact with others, communicate with them, as well as a willingness to play with others. Parents and children also have expressed some emotional and behavioural outcomes. These outcomes are not advantages only; nevertheless, an in-depth examination of the pieces of evidence show that the benefits outweigh the risks of playing MC. However, some of the other concerns expressed by parents regarding playing MC alone or with others are presented in the next section.

10.4 Concerns

Some parents thought that the idea of playing MC alone or with others might not be suitable for their children due to different concerns or limitations. It seems important to discuss these concerns, as they will enrich the discussion and provide an objective

presentation of the data. Some parents reported a general concern. For example, one parent of a child with ASD in the KSA sample stated, “I am afraid of the design of this game and its colours, and the way to play it is very distracted and tiring” (70), and another reported, “games are a calamity and disaster” (71). Another parent of a child with ASD in the UK sample commented, “I worry about the intensity with which my daughter is engaged with Minecraft, almost to the exclusion of the real world around her” (20), and another reported, “I don't think he really has the patience for it [i.e., Minecraft]. He seems to like faster things to play/watch, and that have commentary alongside” (41). However, these concerns may arise because no previous study investigated the role of MC on children’s mental health, which this study aims to address.

Some of these concerns have been reported in the discussion of the social-emotional and behavioural outcomes of MC, to provide readers with a balanced presentation of the positive and negative statements about the experience of MC. Other concerns need to be expressed clearly here as they may go beyond playing MC or may not directly be related to MC, but rather to the playing management or the child’s diagnostic condition. For example, a parent of a child with ASD reported that he is concerned regarding his child’s unrealistic expectation of playing with others, stating,

> He enjoys online games where he can interact with others: Minecraft and Fortnite. But he has an unrealistic expectation of what he thinks his 'friends' expect him to do in the online game (e.g., he thinks he should start playing online as soon as he gets home, as he thinks his friends expect him to do so) (11).

However, it should be noted that unrealistic expectation seems to be a concern for a high number of the children with ASD (Azad & Mandell, 2016), so it is not related to the game itself, it is an impact of the diagnostic condition. Overall, there are four main concerns reported by parents: social-emotional and behavioural concerns (discussed in §10.3) and other concerns that were mainly related to three aspects: addiction, physical activity and Internet safety. All these concerns are important and should be taken into consideration for any MC intervention.

10.4.1 Addiction

A number of parents presented some concern that their children showed signs of addiction, although this study did not target an addiction variable in the research design. A parent of a child with ASD in the UK sample reported that their child “Can become addicted to it [MC], doesn't want to do anything else except this and Roblox” (39). Others from the same group stated, “He enjoys and somewhat obsesses over the game, with many books about the game and merchandise” (10), “My autistic son is 14, he attends mainstream school and every other minute is spent gaming” (38), and “I worry it’s too addictive and he spends hours watching YouTube videos of others” (7). Another parent of a child with ASD and HL in the UK sample stated, “He also is much less frustrated now that he is obsessed with Minecraft” (52). Furthermore, some parents were concerned that MC takes their children’s time. For example, a parent of a child with ASD in the UK reported, “The downside is that she does less IRL creative projects and possibly finds interacting with IRL friends harder, but I think the isolation of being out of school contributes to this anyway, plus the confusions of pre-teen hormones and life changes” (37). Further, a parent of a TD child in the KSA reported, “I think she has become addicted to the game” (77), and another parent of a TD child in the UK stated, “[he] spends a good 10 hours online gaming a day and doesn’t have any other interests or hobbies” (58). Ten hours a day of playing is a massive part of the daily activity and can cause mental health problems. The American Academy of Pediatrics reported that use of digital games for more than 3 hours a day might adversely impact a children’s psychosocial outcomes (Przybylski, 2014); yet, the frequency of playing MC (in this thesis - Table 8.1) does not correlate with the total difficulties scores.

Some parents in the KSA sample also stated this concern. For instance, a parent of a TD child reported, “The child became addicted to it, and it became a large part of his life, which means he speaks about it when he sits with someone” (83). Another statement from another parent with a TD child mentioned that “The only thing I'm concerned about is an addiction to the game. In fact, I do not know the game well, but I see them play it, and I feel it makes them addicted” (84). Furthermore, the

parent of a child with HL said MC was “Good on the one hand and addictive on the other hand to a dangerous degree” (72).

These findings are directly in line with previous research. A study by Al-Dossary et al. (2010) noted that Saudi children have become less active, when spending on average six hours a day using screen-based activities, such as playing computer games. Likewise, Baer, Bogusz and Green (2011) reported that parents of children with psychiatric disorders were concerned about overuse of computers and gaming and tried to investigate the relationship between their use and functional impairment of adolescents, aged 11–17. Researchers stated that being addicted to online gaming was positively correlated with emotional/functional impairment. However, this correlation does not exist when controlling for addiction features. A similar concern was reached by Callaghan’s study (2016), where one-quarter of MC non-players in their sample were concerned about gaming addiction and lesson time wasting, but the latter was not seen by the teacher or researcher. Instead, the teacher stated that students became more productive, extraordinarily engaged and willing to complete desired tasks. Therefore, in this research, a few parents have expressed their fear of how their child might become addicted to the game, and this can be observable among statements made by participants from KSA mainly, but parents may define addiction differently, as shown in previous studies (e.g., Baer et al., 2011). For children with ASD, Mu and Sin (2018) also stated that using MC for students with ASD may increase the risk of becoming addicted to MC, and therefore, teachers and families need to collaborate with each other, and the defined instructional design and material preparation are needed.

In the context of addiction, managing children’s time for playing MC was another concern that was reported by some parents. A parent of a TD child from the UK sample thought that MC has a negative impact on the academic learning time of the child, reporting, “His play pattern impacted his studies. We hardly work with him to finish his homework and study” (64). But, common views among participants indicate that MC has had a positive impact on the child’s learning, with concern over managing the time for playing and doing schoolwork. For example, a parent of a child with ASD

and HL in the UK sample commented, “Whilst personally gaming seems a huge waste of time, I can see that it is hugely beneficial for [him]” (50). Furthermore, another parent of a child with comorbidity of ASD and HL in the UK sample stated,

> There are some detractions of his obsession with Minecraft etc., in that he finds it very difficult to come off it or be time-limited, but it is possible to get him to do this, and this is more than outweighed by the benefits it has given him (52).

Overall, there were a few parents who indicated that managing their child’s playtime was a concern that they faced. A similar pattern of concern was reported by Smolčec and Smolčec (2014), that children spent too much time playing MC rather than doing other activities, such as reading, sport, etc., and that some developed addiction symptoms as well.

To complete the discussion of games addiction, we can consider the notion of a cut-off point of the number of hours when mental health problems start to appear. A study by Lobel et al. (2017) found that higher frequency (approximately 8 hours or more per week) of playing was associated with the increase in internalizing but not externalizing attention or peer problems. One of the TD children’s parents in the KSA sample stated that the child “neglected the house, I mean, the game took a lot of her time, and I am not able to adjust her dealings with the game and how much she plays” (77). The parent seems to be complaining that the child neglected the house routine and isolated herself because of the game. Overall, data show that parents were a little bit concerned about the impact of the game on their child’s home life and being able to manage the playing time, but this may be related to playing time management more generally. Yılmaz, Yel and Griffiths (2018) studied the impact of video games on gamers’ social lives. They found that “heavy gamers” show problematic behaviours, including communication and behavioural problems within the school environment, and prefer to play video games rather than attending school activities, as well as performing poorly in school.

Additionally, one parent of a child with ASD in the UK sample reported that his child “Plays too much” (25), while another parent stated,

> The time spent on a screen device is getting worse, and he has begun watching two devices at once, i.e., iPad (with headphones) and PC. He never wants to go out or do things as a family, and if we do, he clock-watches and complains if he thinks he's going to miss even a minute of his allotted time. His lifestyle is sedentary and controlled by when he can watch TV, next go online or play a game. His current favourite is Kerbal Space Mission, which he argues is educational (teaching him about physics). He can't self-police the time he spends on a device (we limit to 2 hours - twice a day on weekends) and gets angry and shouts if he is asked to get off after this time, saying he was just about to or was just shutting down (it can take an extra 30 mins to do this!) (28).

To summarise this statement, the parent complained about the child's behaviour and attitude, as he seems to be addicted to the game and cannot control his playing time by following the specific rules set by his parents. Nonetheless, this statement did not specify anything about the child's MC playing. A similar complaint was offered by the parent of a TD child in the UK sample, whose child did not play MC, who stated,

> My son loves the game Fortnight. He has been playing it since around December, and I have noticed that he's becoming more irritable. I've made him recognise this and set rules on timings. He already wasn't allowed to play on school days and now has less time at the weekend. It's very difficult for him to get off as other people in the party are still there. I honestly think he could play the whole day, he had dark circles under his eyes when we were snowed in, and I didn't keep an eye on how much he played as much. He does read and play sports too, but I severely dislike the time wasted playing these games. His friends all think I'm so strict as they're allowed on all the time (62).

It can be seen that the parent again complained about two main factors: time control and feelings. In this statement, we see an additional weight on the parents, where the child compares himself to his peers, and where he may have been told that his parents' parenting style is strict, which might be the reason for him not obeying his parents' rules. However, this limitation cannot be generalised because how this particular parent set the standards, and what those rules are, are not known to us.

To summarise, it is essential to keep in mind that higher frequency or length of playing OCG, or MC specifically, do not mean higher social isolation. Although some games may be played alone, games usually have a social part in some aspect (Durkin & Conti-Ramsden, 2014). This was clearly presented in the hypothesis testing, as no identifiable associations were observed between any one of the SDQ scores and the frequency of playing MC for this entire research sample (Table 8.1). However, this impact may appear at a later age, as found by Walker, Hatzigianni and Danby (2018), who studied the association between the use of digital games and cognitive self-regulation on children of 8 and 9 years old. They reported that playing digital games for more than an hour a day is associated with lower cognitive self-regulation and with higher emotional difficulties at a later age. Further research needs to examine parents' definition of addictions, and further examination is necessary to provide a baseline for the type and duration of play that leads to a better understanding of healthy or non-healthy outcomes.

10.4.2 Internet safety

Another concern is that children may learn about the game from YouTube, which may influence their safety. A previous study reported that 37% of children watched YouTube related to MC, where boys aged 6–8 years were statistically significantly more likely than girls to watch MC videos, and older children, aged 9 to 12 years old, were statistically significantly more likely than the younger children, aged 3 to 5, to watch MC YouTube videos (Mavoa et al., 2018). Petry (2018) stated that YouTube and books are stated as the primary resources for getting an idea about how to play MC and be creative. Some parents indicated that their children learn about MC through YouTube, such as a parent of a child with comorbidity of ASD and HL in the UK sample, who reported, "He studies YouTube videos of gamers" (50). However, some parents, mainly from the KSA sample, were concerned that their children learn how to play the game and create a different type of metal and other tools through YouTube, which include many independent variables that have some ethical and moral considerations. A parent of a TD child from the KSA sample stated, "The reason I do not like the game is that the explanations have many inappropriate slang terms and

expressions that are unsuitable for his age" (83). Another parent from the same group commented,

> The problem I face is that he learns through YouTube and often has very bad words that are not suitable for his morals and his religion; thus, I prevent him from watching these YouTube clips [and] they learn the game through YouTube and YouTube is full of bad clips. There are very inappropriate things and words that contradict the principles of my education for them and our home (84).

On the other hand, the parent of a child with comorbidity of ASD and HL from the UK sample reported, "Something I would really love to try is getting [him] to record gaming videos for release on YouTube for securitisation and earning money. My challenge is that I don't have the IT skills to be actually able to set it up" (50). This parent thought differently about how to use YouTube to develop an advantage for the child and use it for their benefit. Another parent indicated that YouTube is a way of learning for their child's gaming, indicating, "He loves watching Minecraft YouTube videos of other people playing or pop song parodies with a Minecraft theme" (34). Whilst a parent of a TD child in the KSA stated that Minecraft is "suitable for those over 15 years old and their times are well scheduled" (76). Overall, it is possible to indicate that YouTube is an essential variable in playing or learning how to play MC for children, but it has disadvantages. A similar concern was reached by Smolčec and Smolčec (2014), who stated that kids learnt an inappropriate language, such as swearing, by interacting with others. Potts (2015) inferred that sexual innuendo was the most frequent theme using a different linguistic tactic that can be understood between players, such as positive evaluation of a male character's nudity, or references to romantic acts and feelings. However, Niemeyer and Gerber (2015) analysed some shared YouTube videos and found that all videos provided something to the viewer, such as how to complete a task, or how to build something in the game. Some players expressed their own preferences of how to create something, and the language used by the creators was suitable for children. This study did not agree with what parents have reported in this sample, and in the study undertaken by Smolčec and Smolčec (2014).

Furthermore, some of the parents reported some concerns regarding Internet safety. For example, a parent with an ASD child in the UK sample reported, “I do not encourage him to play online, as I am nervous about Internet safety” (49). Another parent from the same group specified this concern, although the child is doing remarkable works, stating, “Minecraft occupies him, and he produces remarkable works. It helps that his elder sister likes this. We do not let him play online because of the concern of how he would interact with others” (32). This needs to be addressed in future research, similar to the design of Autcraft, which was designed to offer more safety for children with ASD (Ringland et al., 2015). Therefore, once children learned the game through popular guidelines, such as books, some of these concerns could be reduced; and if children play with only well-known players or in a supervised server, such as Autcraft, then these concerns hopefully could be minimized.

10.4.3 Physical activity

Some parents in this study reported concerns that MC has limited their children’s physical activity, which may lead to a higher incidence of mental health problems; unfortunately, this was not investigated in the quantitative part of this research, but it was mentioned by some of the interviewees (§10.7.4) .

Ussher et al. (2007) studied the relationship between physical activity and psychological well-being in adolescents using the SDQ and found that lower levels of physical activity were associated with higher total difficulties scores. However, some researchers argue that computer games may displace other physical activities and or cause obesity (Kirriemuir & McFarlane, 2004; Wack & Tantleff-Dunn, 2009). According to Sheehan and Katz (2012, p.64), “the more opportunities provided for children to play in the zone, the greater the likelihood that they will develop a positive attitude about physical activity and develop the confidence and desire to be active for life”. In addition, almost ninety-five percent of children who engaged in physical activity reported playing video games, whereas 100% of children who did not engage in physical activity play video game (Mortada et al., 2016), so higher playing was reported for children who do not engage with physical activity. Further investigations

are encouraged to examine parents' meaning and rationale of physical activity or physical play to advance our understanding of the role of games on mental health.

10.4.4 Summary

Parents have different opinions regarding the use of MC for their children. Some of them have support for the game, but others reported some concerns regarding the use of MC by their children. Their concerns were presented in four main points: social-emotional and behavioural concerns (integrated into the outcome section, § 10.3); concerns related to addiction and time management; Internet safety; and physical activity. Parents used different methods to minimise these concerns and mentioned statements expressed some of their own strategies to make MC useful for their child. For example, a parent of a TD child in the UK stated, "I only allow my child to play PlayStation at the weekend. He enjoys it, and I feel like it is a good alternative to violent games" (60). Also, a parent of a child with ASD in the UK declared that they "Don't mind as long as it's balanced out with other activities" (31). In another example, one parent of a child with ASD in the UK stated,

> We don't allow him to play for more than an hour a day, and we make sure we support his playing by asking him questions and extending any points to bring in real-world facts and issues. We don't allow him to play 'survival mode' as we feel this is too violent for his age-group (age 10), especially given that his emotional intelligence is less than others of his age, and his mental health can be fragile (19).

These concerns would limit the social advantage of playing MC with others. Previous studies found that computer games provided a positive context for children's social development and enhanced well-being, problem-solving skills, intergroup relations, and physical activity (Adachi & Willoughby, 2017), taking into consideration that risk exists everywhere, even in books and schools. Consequently, perhaps there were some variables that were out of the scope of this study that might cause this different outcome between parents who found that MC is helpful for their children's learning, and those parents who did not see this benefit or saw a negative impact.

10.5 Other statements

Most of the parents' statements are already reported in the previous sections in this chapter, organized by the main themes of these research questions. However, since all the statements came through an open-ended question in the questionnaire where the participants were asked to provide "any comments or thoughts about [their] child playing Minecraft", some parents reported some statements that are not related to the main objectives and aims of this investigation. Statements that are not accounted for in the questionnaire analysis in §10.2, §10.3 and §10.4 can be organized into three categories. First, statements that are thankful, where parents only fill the comment box with thankful statements, and those are mentioned in Appendix 4, §A with the reference number of 67 and 82. Secondly, there are some that are related either to providing comment about the questionnaire (78) or comment about the child diagnosis (35 and part of the statement referenced 38, 50, 52, 69). Thirdly, some parents included statements that are concerned with academic learning, which is mentioned in the following table. All the five statements indicate that Minecraft has educational benefits to children's learning, similarly to the previous study mentioned in Chapter 4 (Table 4.1, §4.4.2).

Ref.	Statement
37	Since starting to play it I have definitely noticed his literacy and numeracy has dramatically improved - he hates learning in general and disliked reading, yet the game requires him to be able to know how much diamond armour for example he has and also means that he needs to be able to read what he has in his stores/armouries. His knowledge about everyday things has also increased - for example, mining and gemstones, and he is much more interested in the world around him. His literacy has also been boosted by having sufficient motivation to read some Minecraft books which have hints/cheats in them, and he has never ever voluntarily picked up a book before getting into Minecraft.
50	He has a huge memory for numbers and has cracked a lot of my codes. He has promised not to abuse his knowledge, and I trust him.
51	I think it is also helping his literacy and numerical skills as it requires him to type commands, and everything is constructed by cubes. As he is a child who hates spelling or literacy and any curriculum work, the fact that he has to use these skills, even if he requires help to spell words, is a plus.
59	He has gained a good knowledge of different types of minerals.
63	…could inspire a possible career in architecture.

10.6 Children's observation and the interviews

Children's observation and interviews were conducted to collect further information about how children are playing MC (as discussed in §5.3.3). The interview was a semi-structured design. For the observation, almost every movement or action made by the players are presented. For the interviews, there is the theoretical or deductive or the 'top-down' way of identifying themes or patterns within data, where the "thematic analysis would tend to be driven by the researcher" (Braun & Clarke, 2006, p.83). The deductive approach is used because interviews are short, there were only four children's interviews, and those interviews were more directed toward specific questions and data (the interview questions are mentioned in Table 5.3).

10.6.1 Playing MC in the Multiplayer mode

1st child (F)

The first observed child is a 13 year-old Saudi girl, who attends a full-time general education classroom in the final year of the elementary schools for girls. Based on the questionnaire, she has a normal score for all the SDQ categories, except the peer problems scores where she was scored 3 - on the borderline.

The observed player, in this case, begins by constructing the walls of a house with bricks and stacks them from the ground up to the desired height. The process takes a while, which is shown by the changes in lighting in the game to signify day and night. After the walls are completed, she then switched to glass material, breaking down sections of the walls to create windows, and constructing the windowpanes using the glass material. She then begins demolishing the ground to create space for a marble floor with several pattern changes at the corners and in the centre. This change provides the house with a mixture of a neat and colourful look on the inside. She then begins to construct the roof, which also takes a lot of focus and patience given the number of times she demolishes parts of it and starts again. The game offers the players the freedom to choose the type of construction, which is evidenced by the

full range of features they are offered to pick from a menu with various shapes and designs.

In terms of the social interaction between players, the other players [in the same server] interacted with the observed player in mischievous terms, as evidenced by their constant interruption of her creative process. She was a friend of theirs, and they were constructing their houses nearby. They occasionally appeared to check up on her building and tamper with it, much to her distress. They changed the house materials and designs, and she periodically kept pleading through the chat platform for them to stop. One of the other players also replaced the bricks with explosive materials, which would be hazardous to the house in any incidence of an explosion. In general, though, the game provided the player with light-hearted moments as she stated later in the interview, especially when interacting with her friends who serve as her foils.

One of the other players in this study commenced interacting with the observed player by placing TNT on the building wall. She noticed that and destroyed it before it exploded. In the interview, she said that the other player who placed the TNT has "burned my nerves". This expression in Arabic means she felt overwhelmed or very nervous, and she wrote "No" in the chat box to express her emotion to the other player because the laptop keyboard was in English and she was not used to playing with that computer. This frustration is a sign of communication difficulties with other players that might affect day-to-day life for children. After that, the observed player said if the other player who placed the TNT in her house was beside her [physically], she would feel "huffy and angry". She thought that it is "very advantageous that we are not physically beside each other" because she would "hit him if he was beside her". In the interview, she said that these things tend to frustrate her and she tends to interact with others in the same way – that is, with a somewhat sarcastic joke; however, she realised it is a game and, therefore, felt more positive towards the other player. She usually shared her MC stories, such as this incident, with friends, siblings and relatives.

Regarding the communication between players, no communicative interaction with the observed player was noticed, although the second player said “Hi”, but no responses were observed. The observed player was preoccupied with building her house. In the interview, she justified this by saying that it is essential to start the play by building the house to secure her safety during the night. Later, in the recording, during night-time, one of the other players wrote “Hi boys” and then “I slept”, but none of the other players responded. The same player then wrote, “how long it takes till morning” and the observed player responded by writing “11”, which may not be enough. In the interview, she said that she meant 11 minutes, but because she could not write in English, she wrote the number only. During these minutes, other players appeared running beside the observed player, but no form of social interaction was observed. One of the obvious concerns reported by parents was regarding the ability to communicate well with others online as mentioned previously. The absence of communication ability during any social play can be problematic (Mather & Robinson, 2016) which can be noted here and forward in this observed case. Therefore, the ability to communicate through the online gaming platform will facilitate interaction, similar to real-life interactions, where communication is essential at any social interaction (Dezuanni et al., 2015; Kuhn & Stevens, 2017; Mather & Robinson, 2016).The observed player continued building her house and commenced constructing the ceiling, where she carefully chose and selected appropriate blocks, by building and then destroying what she had built and building again with other designed blocks. Upon completion, she decided to save and close the game until next time. After the observation, the observed player was frustrated that the other players distracted her from building. In the interview, she said that these things tend to frustrate her, but she realised it is a game and, contrary to expectation, she felt more positive towards her friends, the other players. She said that all the other players tend to interact with others in the same way – that is, in a somewhat ridiculous fashion. However, this girl’s mother stated that her daughter [the observed player] is only allowed to play with “relatives, such as cousins or siblings and classmates or well-known people”, and that she would “check with whom she is playing every once in a

while, making sure she is playing only with someone I know". This may mean that this frustration was reduced because the child is only playing with known players.

The player stated that she likes the game because "we play it as we live in reality; meaning playing and imagining the real world and help you to grow ideas after". She also said, "I cannot be bored of it, there are many things I can do at the same time that is not available in other games, which are usually designed for one thing". Furthermore, the child said that she "enjoys" playing with others because she can do so whenever and wherever they want. Thus, it can be concluded that MC is preferred for this child because it is endless and helps players to feel they are undertaking something that is like reality. This was similar to the reasons mentioned in previous studies (e. g., Sáez-López et al., 2015; Petry, 2018; discussed in §10.2.1).

In terms of the child's relationships with others, the observed player of the MC multiplayer mode in the KSA sample reported that playing MC together with her friends has let her feel that their relationship with each other is growing because they "can talk about what they do in the game", and sometimes "tease each other in the game". The player reported playing "with [her] two sisters and one brother, and it was a great experience because we can share something and do things together as well as talking to them and discussing the gameplay together". This means they enjoy the interaction. The observed player was asked about her parents' view of MC, and she thought they are more satisfied nowadays with this game. In the past, her parents had heard other parents criticising computer games, but now her parents can see her and her siblings while they are playing together and, therefore, are more satisfied nowadays.

Regarding any concern related to MC and gaming, the observed player in the multiplayer observation of this investigation had expressed related concerns that she is "addicted to the game and would not stop at all. […] I am interested in reaching an end, but there is no end to this game, so I just keep sometimes playing alone, and other times with friends and sibling." However, this observed child did not show any abnormal score on her SDQ, which might be explained by parental time management

for this child's MC playing. Also, the player was asked whether she felt that the game had limited her physical activity. Her response was "no, I do not see any impact".

10.6.2 Playing MC in the single-player mode

2nd child (F)

The second observed child is an eight year-old Saudi girl, who attends a full-time general education classroom. Based on the SDQ questionnaire, she has a normal score for all the SDQ categories, except the Conduct problems scores where she was scored 3 - on the borderline and a score of 4 on peer problems scores, on the abnormal line. This observation was conducted for the child playing Minecraft alone in a single mode. She started playing by opening the game and waited patiently while the game was loading. From the beginning of the game, she started building a neat-looking house. The player's actions seem purposeful and accurate; they do not appear to be impulsive or undeliberate as she was choosing material intentionally. She chose to build the house in a place surrounded by a garden that had flowers, which seems that she deliberately chose the place. It is clear that she had dedicated much effort to create it. The building was well designed and looked like a real-life house; the player seems to have enjoyed what she was doing. It is possible that the girl was trying to recreate her family's home or was designing the house of her dreams.

The actions of the player were slow and thorough; she built the walls of the house brick by brick, weighing her every step. She put every block in the right place and rarely missed the right position. The child's movement was consecutive; she seemed to know what she wanted to achieve while playing the game. It feels like the player was very conscious since there were no unnecessary actions and emotional reactions to the game. Indeed, the girl did not spend her time on useless activities, such as clicking randomly on the objects around her. She was concentrated on making the house look good.

As the house was developing, the player started to choose the materials for the roof. Clearly, she did not want to make any mistakes, so her decisions were deliberate but quick at the same time. It was notable that the girl used all her gaming time to design the house. She walked around the building to reflect on how to implement her ideas and decided to add several candles to the walls. Moments later, the player built a swimming pool on top of the house. The pool was decorated with blue building blocks which the girl had carefully chosen before. Soon, the child changed her mind and destroyed the roof of the building to improve its design. It looked like she had a clear vision of her goal and was trying to implement some elements of it while creating the house, but she was not sure how to do it better. She then decided to build higher walls; the construction looked like a small castle.

It was also notable that the player tried to involve elements of creativity in the building process, using blue construction blocks for the wall along with the yellow ones. The girl's movements were still precise; she seemed to have an advanced picture in her mind or a well-designed plan of her future steps. She tried to choose the best-looking colours and, clearly, was determined to create a neat and functional house. The child barely talked to herself while she was playing; she seemed to have her full attention on the game. The girl spent much time choosing colours and textures for the swimming pool which she was still planning to create on top of the house. Then she built a space for it and filled it up with water. Notably, the player assured herself that all the water blocks looked the same so as to create a natural-looking flow. Suddenly, the child dug a hole in the roof and fell into it. Her motivation for doing so is unclear; she cancelled this step moments later. It is possible to assume that she was trying to build a swimming pool based on a picture of a pool in her mind. After that, the girl walked out of the house to choose some items for the building. She decided to add more doors inside the house. The girl thoroughly reflected on her actions before taking them. She created a small hallway in the house and decorated it with torches. Then the player came to the end as it was asked to stop the recording.

I believe that the player's purpose in the game was to create something that was meaningful to her. It was notable how determined the girl was in designing a

beautiful house. I think that the game could have helped her see how her ideas can be implemented in real life in the future. All the girl's actions seemed to have a purpose; it is inaccurate to say that the child loses her time while playing. Interestingly, the player seems to be a perfectionist as she destroyed some elements of the building to create a better version of them. The girl did not show any irritation or boredom; she was enjoying the game.

When the girl was asked why she plays Minecraft, in the interview, she stated that she plays MC "Just for fun" (similar to §10.2.3). The player also stated that she likes to play MC as (similar to what has been reported by other parents in §10.2.1)

> I can do whatever I want. I can build or bring things I want, to break things, to cut or replace part of the sea, everything. I can choose the colour and design that I want. It has many things that I cannot count, and other games do not have all these options.

The interviewee was asked whether she wishes to play MC in school, and she replied that she did. Then I asked her whether she knows any of her friends/classmates who play MC, but she did not know anyone. She said that she is not interested in playing MC with her friends, but also said, "I do not know" regarding playing with her classmates. She justified that, saying, "I do not care, everyone plays alone". This finding was not clear as she does not want to play with friends but does not have an opinion regarding playing MC with classmates. This finding was not expected, as Cole and Griffiths (2007) suggested that online multiplayer games support players with lifelong friendship skills and create strong emotional stability. However, this might be because this particular child had not experienced MC in a multiplayer mode and the fact that she had been told she was not allowed to play online with other players, which may shape her opinion. Overall, she did not think that talking about the game to her brothers, sisters, friends or peers has any impact on her relationships with them. This might be because she has not experienced playing MC with others as she reported a desire to play with her classmates, and this would let her get to know them better.

Similarly, she was asked how her parents view MC. The girl answered, “I do not know about my dad, but my mam did not like it at the beginning”, and she did not know why. In regard to this point, her mother responded, “I like Minecraft, but I am more concerned about the time spent on playing instead of studying”. This could mean that the child did not fully understand the reason why her mother did not support the game, or the child may not have wanted the researcher to know this.

I believe that, to this player, Minecraft was not a way to escape reality; it is rather a tool to make her dreams come true. It is something that she enjoyed, and when she was asked what things she dislikes in the game, she stated, “nothing”. The child closed the game as soon as she was asked to do so, which might mean that she is not addicted to it; however, her mother was concerned about the time spent on playing, and the child’s quick collaboration might have been due to her being videotaped. The observation reveals that the player used the game as a way to develop her ideas and visions and create the projects based on them. In the interview, the player was less cooperative and did not want to engage with the researcher, which might be due to being a girl (due to a cultural sensitivity issue, as the researcher is male, as discussed in §5.6.4); however, it is also important to note that this player has a score on the abnormal line on peer problems scores and prefers to play alone, which may contribute to this, being less social with others.

3rd child (M)

The third observed child is a Saudi boy aged ten, who attends a full-time general education classroom. Based on the SDQ questionnaire, he has an abnormal score for the total difficulties score (17), and the Conduct problems score (6), but for the Hyperactivity, he was scored on the borderline (6). For the emotional problems, and peer problems scores, and the prosocial scoring, he has scored on the normal line. The observation was conducted for this child playing Minecraft alone in a single-player mode. The child started opening the game and drew circles with the cursor while waiting for the game to load. The child then began playing by trying to kill the animals that were in his surroundings, randomly. Then, he continuously tried to fire arrows into the woods and the sky. Next, the player chose the weapons and other

artefacts he wanted his avatar to have. Those included several types of arrows and potions; he drank a portion of something as he continued to walk around his surroundings.

The child then moved to a different location and started to choose various items of equipment for his character. He selected several materials for building as well. Then the player started to build a railroad, digging some holes along the way to make it curvy. Supposedly, the child did not know what results he wanted to achieve as he removed some parts of the road and made buildings instead, and later shifted back to his initial decision. This also might have been a part of his plan where he wanted to place some obstacles on the railroad and change the direction of the railroad because he did place a railroad curve before the blocks.

It is unclear whether the boy was not sure how the game operates or was bored. He created a long and curvy railroad and put a building block at the end of it again. When the player finished the railroad, he examined whether everything was in the right condition and set a trolley. By the cart, he reached the end of the road and then dug a hole at that point, falling into it. It is unclear whether the child had planned it or not. The player then started to dig himself deeper down the hole and clicked on the subjects around him to see if it could help. He seemed nervous and irritated; the boy did not know what to do next. The child tried to build a construction that would lead him back to the surface. It did not help because he could not jump to the top of his building. When the player realized this, he decided to dig a deeper hole instead. He fell deeper and deeper and reached the point where the textures did not exist anymore. The screen turned red, saying “you have died” that “[his username] fell outside the world” and the boy had to restart the game. In the interview, the child was asked why he was digging a hole beside the train, and he said “I was trying to click on the train, but as I click on it goes deeper and deeper, so I was trying to get out the hole. Then, in the end, I died because I went down so far, so a new game started again.”

The player started the new game by picking the necessary items for his character. He chose several items, including a sword and a bow, and some pieces of blue clothing.

The boy put the selected items on his character. Then the player picked blocks for building purposes; it was clear that his decisions were significant to him as he spent much time on choosing the pieces, which might mean he was trying to protect himself this time from the beginning. At the same time, it seemed that he was not sure how he would use some of the chosen items. The child then walked around his surroundings and decided to exchange some of the things he had selected.

Some moments later, the player started to fly and observed his surroundings from a bird's eye view and noticed a crack in the surface. He jumped inside and decided to light several candles along the crevice. He went deeper and deeper inside, exploring the narrow and dark roads. When the player noticed a bird, he tried to kill it with a sword. The child gave up after several unsuccessful attempts. Instead, he killed another creature that appeared right next to him to gain that creature's belongings. Then the child went back to his starting point and started to build a high wall, then destroyed it after a short time. The player talked shortly to himself and sounded irritated; the purpose of his actions was unclear. Soon, the boy destroyed his building and created another one with a different shape. It is unclear what the player was planning to do. He added horizontally located blocks and built a big wall. Then he created a passage by destroying two blocks in the middle of the wall and closed the game.

I believe that the child became bored and did not know what to do to entertain himself. It was clear that he had no purpose while playing the game or was not able to play naturally while his playing was being videotaped. Some of his actions showed that he might have felt irritated or disappointed. He clicked on the objects a lot, moved around, and did not try to do anything valuable most of the time. Notably, the child remained silent for most of his play. He did not show any emotions while playing the game.

The player likes MC because he "can play and watch your heart [Hearts are signs of the health metre for the player]. I am free; I can build a house or a shelter […] play and earn, for example, enter a cave and break the diamond or gold, make swords, shields…etc." The player's statements again reflected the freedom in playing and

having the ability to do different things. His mother stated that her children “like it because there are different activities, they can do that which are almost similar to real ones, and it is entertaining”. The mother added that MC provides children with the ability to feel real and exercise their imagination and that was a reason for becoming interested in MC. All these statements confirmed what some previous studies have found about MC for TD children and statements provided by his parent at §10.2 and the parents’ statements at §10.7.1.

Indeed, the interviewee stated that he likes MC because he can “play with people”. Although he was not playing with others in the server during the observation, this may indicate playing with his friends and family members besides each other as he noted so. This also explained why he seemed to be irritated or bored with the observation session, as he was alone.

In terms of the social part of the game, he said he has friends and siblings and could play MC with them, but he did not talk about the game with them or about what he has done in the MC world. The same child, on the other hand, reported that playing with his friends would develop their relationship with each other because they “can do things together and we can challenge each other”. This may indicate that he plays MC with others physically beside each other, but not in a multiplayer mode and this, according to him, is still useful and can contribute to their relationship with each other. He defines sharing play as “building things together; for example, woods, doors, windows, everything”. In addition, he was asked whether he would advise his peers to play MC, and he replied, “No, they can know about it from themselves”. He does not plan to advise them to play MC because “everyone plays what they like in the way they like; it is not my [his] business”. I asked him whether he wishes to play with his classmates after school, and he said he does but that he does not want to play with them at the same place, rather he likes to play “from a distance, so everyone joins the server from his [their] house”. Therefore, from interviewing him and his mother, I felt his opinion is not consistent, but then after more questioning, he seems to prefer to play with others but from a distance. This is an advantage of playing in multiplayer mode and where he felt there was an improvement in his

relationships with other players, although he was not observed playing with others during those sessions. Last but not least, the video reveals that the player did not follow purposeful actions most of the time and did not have clear objectives while playing the game. He was asked whether he usually has a plan before starting to play, and he responded, “I do not have a plan, I start to play randomly”.

To me, it was interesting because the boy’s actions reveal that he was not feeling calm while playing the game. I believe that the player might not know what to do or it was because he knew that he was being videotaped. It might be the boy’s way of coping with the reality he faces in his real life. Alternatively, this might be because his score on hyperactivity/inattention was on the borderline.

10.6.3 Do not play OCG

The fourth observed child is a Saudi girl aged eight years old, who attends a full-time general education classroom, and who had not played Minecraft. Based on the questionnaire, she has a normal score for all the SDQ categories, except abnormal scores for the total difficulties score (18), the emotional problems score (7) and the Conduct problems score (5).

In this observation, the child used her iPad to play a different type of game, because the child does not play Minecraft. The child started the observation by playing simple mathematical games based on additions with eye-catching images to draw the attention of the player and train her on the basics of mathematics. Every time she answers the questions correctly, she would receive coins placed into her basket. Once she has filled the basket, then she would receive a cupcake or a piece of pace as a reward. Then in the next stage, she is asked a higher level of additions exercise. All these exercises include a modelling of the numbers in different shapes, to help the child to solve the additions exercise. Through the beautiful pictures that comprise fruits, food and other lovely items, the exercise seems to instil knowledge in the child. She then closed the app.

After that, she opened a game called “I love to eat” made by Baby-Bus company, the goal of the game seemed to be teaching the child how to be independent on

preparing a simple breakfast or lunch. The child first was presented with several dishes with different colours, and she had to select three dishes only and place them on the table. Then the child was provided with a select food menu where she could choose from the categories of vegetable, meat, bread …etc. Then three different pieces of vegetable were presented to the child, and she had to select only one type of food for each dish. She chose a fish, bread and rice and placed each type on one dish. The game then modelled washing hands, and then the game taught the child the advantages of eating each one of the meals, for example when the child ate the meat, the game told her that it strengthens her immunity, and simply through pictures of bacteria that are fought because the body becomes stronger. The child then finished eating her meal and closed the game.

The child then opened another game called “find differences” made by the same company, and the goal of the game seemed to be to inform the child about the concept of ‘strangest’. For example, a room filled with a different type of people eating their meal and the child was asked to find strange things. In the room, there was a dog holding a meal dish above his head, and a dog that was working as a waiter, and shoes that are placed in one of the dishes. The child was asked to find these strange things in 30 seconds. Once the child found one, she received a star. The child then was told that everything was different and changing over time and being different might be an advantage. The child then was provided with a harder task. Once she finished it, she closed the game.

After that, the child opened a game called “I am the smart photographer”, also provided by the same company. The game asked the child to make up a girl using different tools which made it happy and then take a picture of the girl. Then the images went through an image processing, and the player selected the one they took and went through images improving the process, and then printed them, and cut them separately. The goal of this game was unclear to me, but it might be to teach children the process of taking a photo and how it can be improved. Once she had hung the picture up on the wall, she closed the game.

The player then opened a game called “Tough fingerprint”, again provided by the same company. The purpose of this game was that kids like to touch the screen of the mobile and play and tamper with it, and so the game takes advantage of this curiosity in children and makes them touch the screen to show a fingerprint and turn it to multiple characters and things of interest, and then touch it again to turn things beautiful whenever you touch anywhere on the screen showing your fingerprint. The child played with the game for a while where she showed her fingerprint in a different location, and clicking on these fingerprints showed a nicer picture, movement and sounds. The child then closed the game and moved forward.

The player then opened a game called “Fisherman”, provided by the same company. The purpose of the game was to allow the player to help "Kiki" to catch the fish; get to know the different fish types, with different fishing methods; learn about the different types of fish and their characteristics and how to live; as well as to learn much new information about the life of fish within the world of the sea. The player played with different fishing methods and showed a different type of fish and then she found a treasure box, where she became very rich. The player also experienced a model for taking a boat to go fishing and to catch some type of poisonous fish. The player continued fishing until all the fish around her has disappeared. The child then closed the game.

The player then opened a game called “Teaching participation/sharing”, also provided by the same company. The application seemed to be designed to teach the child about sharing and the advantages of sharing play, food, drink and everything with friends. If your child did not share everything with others, they and the animals would get angry and grieve. Each one of the kids bought something, and then the player had to share it and divide them between the kids in the game, which made them happier. The child then closed the game. Then the child was asked to stop playing because the video recording time had finished, and the observed player closed the iPad happy.

In the observation, I realized that the child mainly selected and played educational games, and thus I asked her why she decided to do this. The child reported that she

likes these games because they support her learning in school, and because they are useful and not boring; however, she does not like that they have music. She thought music is noisy, so she cannot focus and some of the games incorporate the music with the instruction, so she cannot turn it off. I then asked her whether she would like to play them in school, she said yes, but she still prefers to learn from the pen and blackboard because “the iPad hurt our eyes. I know that anything that moves quickly hurt my eyes, but the blackboard is stable and does not change quickly.” She wishes she can use the iPad as a supportive tool, especially while waiting for her parents to come and pick her up, instead of just waiting.

Regarding the selection and choice of games, the mother reported that her daughter likes to explore things in games and look for things, not only in the game but even if when watching the TV, and she is very self-confident in choosing the game, but mostly observing what type of games her friends and siblings play. Indeed, all these games [played during the observation] provided the children with skills that equip the learning requirements that eventually help them to become successful individuals. Using appealing items was essential in all those played games and it was important because it enabled capturing the attention of the children as is evidenced in the observation. To summarize, the contents of the observation for this child denoted the learning process through these games she had chosen. The stages contained in the clip inform that the child went through a process that let her choose specific games, which was clearly discovered through interviewing her and in the parent's interview. Through observations and experiments in these games, children slowly decipher what others do and relate them to the associated feedback, a process that they later demonstrate alone or with their peers. Therefore, it is common to witness small children behave in a manner that is in line with their observation at home or in school. Child activities exhibited in the observation represented various components of learning that include imitation and modelling, as well as interaction and development of interpersonal skills that are useful in understanding the psychology of human development.

10.7 Parents' interviews

Parents' interviews were conducted to collect further information about how their children are playing MC and parents' perspective of their children's gameplay. As discussed in §5.3.3.2 and 5.5.2, the interview was a semi-structured design, allowing the researcher to concentrate on the topics and issues and be more focussed, with questions being prepared mostly before the interview is conducted. For the interviews, the theoretical or deductive or the 'top-down' way of identifying themes or patterns within data was utilized, where the "thematic analysis would tend to be driven by the researcher" (Braun & Clarke, 2006, p.83). The deductive approach is used because the interviews were short (average of 09:45 minutes), there were only three parents' interviews, and they were more directed toward specific questions and data (Table 5.3). Data analysis is presented in 5.5.2.

10.7.1 Reasons for playing MC

Similarly to what is reported in the parents' statement from the questionnaire (§10.2), and the children's interview (§10.6), parents were asked why their children are interested in MC and whether they know any particular reason for playing MC. The parent of the observed child who plays MC in multiplayer mode stated, "It is her favourite game to play and to spend her free time with entertainment". Furthermore, her mother stated "she [her daughter] is interested in Minecraft because it has allowed her to do whatever she wants to do, and she can play with others from home" and allows her to "play with her friends and develop herself by herself". Her parent indicated observing her daughter's playing sometimes and sees her "construction and demolition, and the formation of sheds and houses". Likewise, the mother of the observed children who played MC in single-player mode stated that her children "like it, because there are different activities, they can do that which is almost similar to the real ones, and it is entertaining". The mother added that MC provides children with the ability to feel real and exercise their imagination and that was a reason for becoming interested in MC. They usually build, demolish, straighten sheds, plant, harvest and do everything they want to do. All these statements

confirmed what some previous studies have found about MC for children, which was reported and discussed previously in §10.2.

In contrast, in the interview of the parent of the child who had not played MC, the parent stated that her girl likes games that provide something to learn, such as maths or literacy, and that she "does not like other games and she may download them and then delete them quickly". However, the parent stated she sometimes used the iPad as a reward if her daughter does a good thing, and she used to ask for it as a reward. This is not similar to what has been reported by the interviewed parents whose children have been playing MC, which may be due to MC, or an individuals' performance differences, or accessibility (as MC is a paid game, and might not be affordable to every child).

Thus, it can be concluded that MC is preferred because of four main reasons, it is endless and helps players to feel they are undertaking something that is like reality, freedom to be creative, peer interaction, and entertainment. This is similar to the reasons mentioned in the parents' statement from the questionnaire and the previous studies (e. g., Sáez-López et al., 2015; Petry, 2018; discussed §10.2).

10.7.2 Playing with others and developing relationships with others

The mother of the MC single player mode reported that although her children like to play alone, she reported that MC has helped her children to be close to each other and with their friends, as they have a common interest. The mother reported that they are talking about their achievement and how to do things with each other. She stated, "they love to talk about it so much, and most of their conversation is about this game. They always call me and ask me to see what they did or achieve, such as 'see we did farms or place sheep stockyard'." The mother reported that sharing this interest has impacted their relationship with each other positively. But for her [the mother], she said "I do not like that they talk about it all the time. It becomes very boring for me." Therefore, similar to what has been reported in §10.2.2 and §10.3,

the game may provide children with a shared interest and be a tool to develop their social interaction with each other.

Playing with others in the multiplayer mode and on the same server may also help children to be more socially connected. The parent of the girl who plays MC in the multiplayer mode reported that her daughter's relationship with other players seems to be developing and in a good manner, although the mother reported that she only allowed her daughter to play with known people, such as her relatives or her friends to make sure about her safety and for cultural and religious reasons. This girl's mother stated that she [the observed player] is only allowed to play with "relatives, such as cousins or siblings and classmates or well-known people", and that she would "check with whom she is playing every once in a while, making sure she is playing only with someone I know". This may mean that this frustration [of the TNT accident reported in §10.6.1] was reduced because the child is only playing with known players. Importantly, the mother thinks the players' relationship with each other, including her daughter, is positive and they are well connected and well organized through the game and "They can play with each other from a place that suited everyone". The players communicated well with each other, and they "Talk about the game, such as saying I did such and such and then they argue whether it is right now the other player should say so". It is important to note that it is reported that the observed child has administered a shared server, and she is a leader and the mother thinks she knows more than anyone else (people she plays with) about the game. Therefore, MC seems to be a tool that can be used for social and communication interaction with others, similar to what was reported in Chapter 4 and summarised in Table 4.2, (e.g., Dezuanni et al., 2015; Hill, 2015; Nebel et al., 2016).

In contrast, the parent of the child who had not played MC reported that she also observed her daughter talking to others about the games and "discuss what games they download and how to play …etc". She also thinks that playing games on the iPad with her daughter's sibling has helped to positively develop their communication and relationships with each other. The mother stated "They [her daughter and sibling] mainly talk about any game. For example, talking about what they had achieved, and

how she plays, so she mostly talks about her stories with these games." Furthermore, the mother reported, "I do not remember them fighting for a specific game, because they can download them all, but they may fight about who gets the iPad". Interestingly, the mother reported that the games are very useful to develop her own parental relationships with this particular daughter because "she plays some educational games that teach her to respect parents and how to deal with them as well as relatives rights. That is why some games may be more beneficial than others, such as racing or car games, it depends on the game type." Importantly, the mother also indicated that there is a huge social part in using an iPad and playing specific games, as her daughter takes it as competition for most of the time and if there are no other children playing on the iPad, she would be more interested in the TV. Therefore, in this specific example, it can be noted that games can be used as a social and connective point between the children, which may make them useful for social intervention regardless of the game type. This is similar to what has been reported by previous studies, Table 4.2 and this research's participants §10.3.

10.7.3 Academic aspect

Although this thesis did not fully include the effect of online computer games or Minecraft on children's learning, some parents provided some statements about their children's learning (§10.5) and previous studies reported that MC has been used for academic learning (Table 4.1, §4.4.2); therefore, in the interview, parents were asked whether the game has been used for academic learning or whether it has any impact on their children's academic achievement. The parent of the multiplayer mode player reported that her children sometimes learn things through playing MC with others, such as learning about metals and raw materials and the process of building and construction. However, the same parents also reported that playing MC has some disadvantages on children's studying, such as "they start to forget about their homework and just keep playing. The game takes most of their time, and then become tired and they do not want to study." Similarly, the parent of the observed child who plays MC in single-player mode reported positive learning, such as "teaching children how to plan for things and then organize themselves to do it. For

example, build things together and do things together." However, this mother also reported that she thinks MC has a negative impact on their academic achievement as "They do not study and spend most of their time playing instead of studying, reading or writing". Thus, both parents thought MC has a positive impact on a child's general learning, but a negative impact due to playing time management (which has also been discussed in §10.4.1)

In contrast, the parent of the child who had not played MC reported that her daughter "likes to learn strongly, she loves to learn frankly from herself with these games. I mean, she likes to explore things and look for things." The mother indicated that her child is very self-confident in playing educational games and is always learning by playing, as she learns "Everything, from mathematics to science to literacy to personal skills, such as taking the initiative, for example, interest in cleanliness, attention to brushing teeth, and things that are hard to teach but she learned them from the games". However, the mother also reported that "when she plays for a long period, she becomes very nervous, and does not benefit from playing anymore. I mean it is never useful to allow her to play all the time. She becomes very exhausted and is not willing to study." The parent concluded that she "thinks these games are very useful, she [her daughter] learns many things through them, but importantly, I think they should not play them all the time as children should use them for a maximum of three hours a day. I give my kids the iPad every day, and my daughter learns many things through the iPad, such as the wudu (ablution; Islamic procedure for washing parts of the body, a type of ritual of purity before praying). She memorised the Quran, songs, and morals through these apps." Therefore, this is similar to what has been reported by other studies (Table 4.1, §4.4.2), that games can be used for teaching academic subjects.

10.7.4 Concerns

Parents also reported some different concerns or limitations of playing MC, similarly to what has been reported by other studies (discussed in §4.54.4.2) and the parents' statements from the questionnaire (§10.4). These concerns are very important to

discuss to enrich the discussion and provide a balanced presentation of the data. Parents in the interview reported three main concerns, which are addiction, Internet safety and physical activity.

Addiction and time management are the main concerns reported by parents. The mother of the observed child who plays MC in multiplayer mode said, “It [MC] is good, but it consumes her time, so I sometimes refuse to allow her to play”. The mother also was asked whether her daughter understands her perspective or point of view about MC, and the mother replied, “I am not sure because they always come and ask why and ask me to watch how they are playing, and talk about how they feel about the game”. She continued, “I understand their views, but I refuse for the sake of their time, and because they refuse to stop until I have to shut down the device”. She concluded, “I would appreciate it if they do not waste all their time with it”. In order to limit this, the parent reported that she does not allow them to play more than two hours a day. Overall, the parent reported, “I think MC is a good game if it sticks to a time-limit, and I want her to set the time and stick with it. I do not want to come and turn off the computer myself.” Similarly, the parent of the MC single-player mode player was asked about MC, and the mother responded, “I like Minecraft, but I am more concerned about the time spent on playing instead of studying”. The mother added, “Sometimes he plays so much and then becomes very nervous and does not want to listen to anyone and insists on continuing after being asked to stop”. This would indicate that this child might be addicted to the game; however, the frequency of playing MC in his questionnaire was below the average of the whole sample.

In terms of Internet safety, the interviewee reported similar concern mentioned in §10.4.2. The mother of the observed child who plays MC in multiplayer mode reported that one of the main concerns is that her children learn how to play through YouTube, but she does not like the bad words used by YouTubers and have heard their child saying these words. In order to limit this concern, the parent reported that her children are not allowed to listen to YouTube videos about MC anymore unless the sound is mute. The mother of the MC single-player mode players was asked how

their children play MC and reported that they mainly learned through their friends and YouTube. Regarding the children's online safety in general, the mother said, "I want them to be self-controlled, so I warn them about risks and observe them from far and intervening only once I see a risk".

Since some of the previous studies reported that online games may limit children's physical activity, the parents were asked whether MC has a limitation on the children's regular physical activity. Some parents in this study reported concerns that MC has limited their children's physical activity, which may lead to a higher incidence of mental health problems; unfortunately, this was not investigated in the quantitative part of this research, so no statements have mentioned this limitation previously. In the interview of the MC multiplayer mode child, the player was asked whether she felt that the game had limited her physical activity. Her response was "no, I do not see any impact". However, her mother said, "They began to play it, forgetting their time and wasted it in the game". In the interview of the parent of the MC multiplayer child, the mother reported that her daughter "has established and led a server to play with her siblings", and that helps her daughter to be "satisfied with herself as I felt she had increased her self-confidence" because "she became the leader when they play with relatives or friends". This could be considered as an advantage for the child's social, friendship and leadership skills similar to previous studies (reported in Chapter 4 and summarised in §4.4.3; also see, e.g., Dezuanni et al., 2015; Hill, 2015; Nebel et al., 2016). However, this does not mean that MC has a role in reducing her physical activity or physical play. Another example is that the parent of the MC single-player mode players reported that her children like to play physical games, although they like to play MC more and that she is not concerned about this, rather that she is concerned about the overall time spent on online gaming including MC.

In comparison, the parent of the child who had not played MC reported that addiction to games is a concern, although her child played offline educational games. In terms of Internet safety, the mother reported, "I reduce the amount of allowed hours, and I make sure that she only plays a game that I know and does not have an impact on

her mentality. I see the games, and I ask others about them before I download them to my iPad." However, the mother was asked whether she has checked whether these games are appropriate for her child's age and she said no. This mother stated, "I choose based on their desire. They decide based on what they see others playing or hear their friends talk about it. So they discover the game, and then I see whether it is suitable or not based on my own judgment, and then I decide whether to leave it or delete it." Therefore, the main concern for this parent is that her child may become addicted to the games, although these games are offline ones and played by the child alone.

10.8 Chapter Overall Discussion and Conclusion

Differences in parents' statements regarding the outcomes of playing MC are expected because each child has different experiences. This allies with the philosophy of pragmatism (for more information, see § 5.2), as it highlights individual differences: what works for one child may not work for another, and what works at one time may not work at another time (Brennen, 1999; Ormerod, 2006), especially considering the individuality of children with special needs (Durkin, Boyle, Hunter & Conti-Ramsden, 2013; Durkin & Conti-Ramsden, 2014). Therefore, no single factor can be generalised to all children with ASD, HL or TD in both countries, but after examining the evidence presented in this chapter, it can be concluded that the advantages outweigh the disadvantages as most of the reported concerns are related to gaming management rather than MC itself. MC, as a form of OCG, can be a facilitating tool to overcome their social and emotional difficulties or consummate their needs of compensatory pleasures with enjoyable practice (Durkin & Conti-Ramsden, 2010). Children with HL need to not only learn to understand and manage their social skills and emotions feelings, but also to be able to interact with others, exercise good judgment, make healthy choices, and be responsible for their choices and actions (Luckner & Movahedazarhouligh, 2019; Melnick et al., 2017). As some parents of children with HL previously stated, MC has helped their children with HL to administrate these skills to some extents, which is much appreciated.

In line with the benefits of MC to children's social learning and parental concerns, previous studies have differentiated between the outcomes of cooperative and competitive games (Chan et al., 2017; Clark et al., 2015). Hanghøj, Lieberoth and Misfeldt (2018) reported that cooperative games resulted in a positive students' engagements and social participation due to their fun element. Moreover, Lobel et al. (2017) reported that cooperative gaming, such as MC, is not significantly associated with prosocial behaviours; however, competitive gaming was associated with decreases in prosocial behaviour only among children who played video games with high frequency. This also was seen with the quantitative outcomes of this research, as a higher frequency of playing general OCG (not MC) is associated with higher peer relationship problems (Table 8.1). Thus, previous research that presented gaming concerns regarding children's mental health might not be relevant to MC, as MC is a cooperative game (Nebel et al., 2016). Furthermore, Kovess-Masfety et al. (2016) studied this issue with a sample from six European Union countries (children aged 6–11, n=3195), and reported that high gaming frequency is significantly associated with lower peer relationship problems and mental health difficulties as well as lower prosocial deficits. This also allies with the quantitative outcomes in the previous chapters where long lifetime duration of playing MC is associated with a lower total difficulties score for children with ASD in the UK, and higher prosocial behaviour for children with ASD in KSA (Table 8.1), which is a strength according to the SDQ (Goodman, 1997). Therefore, after an examination of parental statements, this thesis argues that MC can be useful for children's social-emotional and behavioural development, especially with children with special needs, such as ASD or HL.

This chapter has addressed the qualitative data, seeking to understand the phenomena of playing MC from the perspective of parents and children's observations and interviews. Reasons of being interested in MC can be summarised into three aspects: having the freedom to be creative and imaginative, offering a space for developing peer relationships and peer interactions, and being a world of entertainment and enjoyment. These three features are very important in developing

our knowledge of gaming and mental health, especially for children with special needs. We need to understand these reasons as they may fulfil those children's needs, and then consider using these features (that made MC an interesting game) for future social interventions, especially intervention that aims to provide children with ASD with an enjoyable and meaningful place for learning. Children's personal interest must be followed and allowed to develop naturally within the curriculum for the best educational practice (Gunn & Delafield-Butt, 2016), and MC can be a tool for this.

This chapter further presented the qualitative positive and negative outcomes of playing MC, in relation to three themes - social outcomes (i.e., it creates social and communicative interaction opportunities), emotional (i.e., being calm, happy and relaxed), and behaviour (i.e., practising of real-life situations and behavioural management). Previous studies also found that social ties with other players form in-game are highly connected to positive psychological well-being (e.g., Depping et al., 2018). Altogether, an in-depth examination of the pieces of evidence has shown that the benefits outweigh the risks of playing MC. Therefore, these findings illustrated that MC could be helpful in involving children with ASD with social life and provide them with a better mental health world.

Finally, this chapter presented three primary concerns in regard to playing MC: addiction, Internet safety and reducing physical activity. Parents reported different methods to minimise these concerns and to make MC useful for their children, such as making sure that the playing is balanced, choosing the right time, and choosing the right playing mode for the child. These concerns may limit the social advantage of playing MC with others, but it should be noted that these risks are existing everywhere, even in books and schools. Importantly, after examining these concerns, it can be seen that they are related to gaming management rather than MC itself as a game. Consequently, further experimental examination is necessary to provide a baseline for helpful versus harmful MC game-play, taking into consideration all reported variables in this chapter (e.g., diagnostic condition, playing with well-known

others versus unknown players, cultural, age, gender and the frequency of playing) that leads to a better understanding of healthy or non-healthy outcomes.

CHAPTER 11: GENERAL DISCUSSION AND CONCLUSION

11.1 Introduction

This final chapter summarises and discusses an overview of the thesis. It starts by underlining the rationale of the study, and the findings. This investigation sought to understand the impact of Online Computer Games (OCG) and Minecraft (MC) in the social-emotional and behavioural outcomes for children with Autism Spectrum Disorder (ASD) or Hearing Loss (HL) using convergent mixed method design approaches, using the results of the qualitative data to explain the outcomes of the quantitative survey. Further, the limitations of the thesis are also discussed in this chapter and followed up with recommendations for further research and future implementation for teachers and practitioners. This study's unique contribution is discussed in the following section.

11.2 Overview of the Study

Children with ASD or HL have difficulties in developing social relationships (Antia et al., 2011; Baron-Cohen & Bolton, 1993; Batten et al., 2014; Bertilsdotter-Rosqvist et al., 2015; Chilvers, 2007; Luckner et al., 2012). Furthermore, children need to develop their relationship skills, which can be the foundation for developing social and communication skills (Bagwell, 2004; Strauss et al., 1986). Studies have found that it is easier to develop such a skill in childhood than in adulthood (Sherman et al., 2000), mainly relationships with others as people become more independent in adulthood (Berndt & McCandless, 2009; Ferrer & Fugate, 2014; Newcomb & Bagwell, 1995). A child's mental health status also has a significant impact on relationship skills and vice versa (Kawachi & Berkman, 2001). Children with anxiety or depression tend to show less interest in forming relationships with others (Zahn-Waxler et al., 2000). Difficulties in making friends may lead to many forms of mental health problems and can increase the risk of various negative psychosocial outcomes (Newcomb et al., 1993). Peer relationship problems are associated with a greater risk of developing learning difficulties (Wentzel & Asher, 1995). Thus, this study is critical because it

aims to provide a better understanding of the impact of OCG, specifically MC, on children's social-emotional and behavioural outcomes, including peer relationship skills, as these are vital for children's independence, vocational life and well-being.

Parents of children with developmental conditions have, in general, been concerned with regard to their children's special needs and well-being (Conti-Ramsden et al., 2008), so this study attempted to provide further information about the impact of OCG on children with ASD or HL, as well as contribute to the current knowledge of the association between MC and relationship skills for these children. Another essential gap is that there is no identified research on gaming in the Kingdom of Saudi Arabia (KSA). It is believed that this is the first research project undertaken to try to understand OCG or even video games and MC in this area.

11.2.1 The systematic review

As part of the preparation for this thesis, as explained in Chapter 4, a systematic review was conducted of all published research into the use of Minecraft/Autcraft for educational purposes to summarise and synthesise the current literature. This included all first-hand-data and peer-reviewed papers in educational, sociological and psychological research, written in English, since the time of the game's launch in 2010 until March 2019. Thirty-eight papers were identified. The systematic review concluded that no published research had attempted to understand the impact of the game on children's relationship skills and mental health status. In addition, a gap was identified where there had been no study on the impact of MC on children's mental health, in general, and specifically on their peer relationship and friendship skills. In addition, none of these articles included children with ASD or HL in their sample, except for a few papers published in conference proceedings (discussed in § 4.5.4).

Previous research has demonstrated that MC is helpful for learning and social psychological development for young people in the general population. It has been reported that playing MC promotes a player's social skills, such as sharing and collaboration skills (Bebbington & Vellino, 2015; Davis et al., 2018; Petry, 2018; Hong-

An, 2016), communication skills (Niemeyer & Gerber, 2015; Mather & Robinson, 2016; Hill, 2015; Quiring, 2015), engagement and leadership skills (Elliott, 2014; Dezuanni et al., 2015; Hollett & Ehret, 2017; Rexhepi et al., 2018; Nebel et al., 2016; Marlatt, 2018), academic learning such as language skills (Cipollone et al., 2014; Marcon & Faulkner, 2016; Smolčec & Smolčec, 2014; Swier, 2014), computer skills (Acholonu et al., 2017; Motschnig et al., 2017; Saito et al., 2017), and teaching historical topics (Craft, 2016). Therefore, a contribution of this study has been to confirm three important gaps: (1) the use of MC compared to OCG in general; (2) the association of playing MC on children's social-emotional and behavioural outcomes; and (3) the association of MC play on children's peer relationships, especially for children with ASD or HL.

11.2.2 Current use of MC among the research sample (ASD, HL, and TD children)

The findings of Chapter 7 are important for the current state of knowledge regarding understanding the rules of the country and diagnostic condition in the online gaming choices. The type of playing between the two countries are different (Table 7.1), and girls in the KSA sample are less likely to play MC in the multiplayer mode (Table 7.8). In terms of the differences between ASD and TD, the outcomes can be summarised as follows: (A) the number of children with ASD in the UK sample is significantly higher in the MC multiplayer mode than in the single-player mode (Table 7.2); (B) children with a higher score of ASD severity in KSA are more likely to play in single-player mode (Table 7.10); (C) children with ASD are more likely to play alone than the TD children in both countries (Table 7.4); and (D) children with ASD in the UK have a higher lifetime duration of playing MC and play MC more often than TD children (Table 7.6). These differences in the countries and the conditions are argued in regarding two main aspects (presented in depth in § 7.8). Firstly, cultural differences in KSA in regards to educating and supervising children with ASD in that country, accessibility to online tools and gender equality, i.e., children in the Western countries have higher use of technologies (Newzoo, 2013, 2016, 2018), better autism serveries and knowledge (Mashat et al., 2014, 2015; Mazurek & Wenstrup, 2013), and more gender equality (Alolyan, 2015; Heble, 2007; Lenhart, 2015). Another possible explanation is

that MC may be suitable for English speaking players with more socialisation activity, due to its languages and popularity (Ringland et al., 2015; Ringland et al., 2016a; Ringland, 2019). These two aspects may explain the differences in outcomes in this sample, although response bias can always be presented as the research is voluntary. Furthermore, children with ASD are more likely to play alone than the TD children in both countries (Table 7.4), and at the same time, are more likely to play MC in a multiplayer mode in the UK sample (Table 7.2). This outcome can be argued in regards to two main reasons. First, children with ASD may prefer to play with others but this was not perceived well by parents due to two possible factors, as what may appear to TD people regarding autistics' behaviours may not be truly what a person with ASD thinks (Delafield-Butt et al., 2018; Jaswal & Akhtar, 2018), or because parents have been told that children with ASD feel more relaxed when left alone (Bertilsdotter-Rosqvist et al., 2015). The second possible reason is that children with ASD may prefer to play alone physically, but not in an online environment. Overall, the outcomes of this comparison are important to establish the scene of examination of the impact of MC on children's social-emotional and behavioural outcomes.

11.2.3 Associations of MC with social-emotional and behavioural outcomes

In regarding the results to emerge from the analysis of the findings in response to the second and third research hypotheses (presented in Chapters 8 and 9), it can be concluded that MC is not less valuable than other playful activity and does not have specific concerns for this research sample and might be beneficial to be used as a place for social intervention for children with ASD due to a few reasons. First, there were no negative outcomes of playing MC variables on children's social-emotional and behavioural outcomes (Table 8.1) among all the sample groups. Second, higher frequency of playing MC with others is significantly associated with lower peer relationship problems score for children with ASD in the KSA sample (Table 9.1), and playing MC with others made a significant contribution to the prediction of peer relationships problems scores (Table 9.2). The third reason is that the qualitative pieces of evidence (§10.3) show that the benefits outweigh the risks of playing MC, notably for children with ASD and HL. Thus, MC is not less valuable than other playful

activity that can be used as a place for social intervention as it does not have specific concerns for this research sample.

This conclusion supported the outcomes of previous studies that cooperative gaming has advantages on children whereas competitive games were associated with some negative social-emotional and behavioural outcomes (Bossavit & Parsons, 2018; Dolgov et al., 2014; Lobel et al., 2017; Nebel et al., 2016; Mu & Sin, 2018). This investigation found that higher frequency of playing OCG (excluding MC) for TD children in KSA was correlated with peer relationship problems (similar to the outcomes of Page et al., 2010; Parkes et al., 2013; Strittmatter et al., 2015; discussed previously), but this was not presented in MC nor in the TD children in the UK.. Contradictory to this thesis outcomes (i.e., higher frequency of playing MC with others is significantly associated with lower peer relationship problems score for children with ASD in the KSA sample, Table 9.2), Cai and Nguyen (2018) inferred that there are no significant associations between gaming frequency and peer relationship problems, but the study of Cai and Nguyen did not take into account the playing with others variable and the condition into consideration; thus, the positive outcome, might have occurred due to being autistic and playing with others. Overall, the differences in the findings of MC have some limitation to be discussed with the cultural factors as no similar studies have been conducted in KSA regarding studying the role of OCG, in general, on the social-emotional and behavioural outcomes. Lobel et al.'s study (who reported that higher gaming frequency is associated with higher internalising problems, anxiety, and depressive symptoms) is from a European cultural perspective (González-Bueso et al., 2018), and this thesis found that the two countries (UK and KSA) are different in many variables (§7.8). Hence, to the best of the researcher's knowledge, this is the first study to examine games in KSA.

As set out in the conclusion of Chapter 10, parents reported three reasons of being interested in MC: having the freedom to be creative, offering a space for peer interactions and being a world of entertainment and enjoyment (similar to other types of OCG, reported in Kirriemuir & McFarlane, 2004; Tsikinas & Xinogalos, 2019). Understanding these reasons is important as they may fulfil those children's needs,

so consideration of reusing these features for future social interventions is imperative to provide children with a common interest and an enjoyable and meaningful place for learning. Parents in the qualitative part of this study reported three outcomes of playing MC. The first is social outcomes (i.e., it creates social and communicative interaction opportunities), confirming the outcomes of previous studies (e.g., Bebbington & Vellino, 2015; Dezuanni et al., 2015; Hong-An, 2016). The second outcome is related to emotions and feelings (i.e., being calm, happy and relaxed), analogous to the outcomes of previous studies (e.g., Hill, 2015; Nebel et al., 2016). The third is related to behaviour (i.e., practising of real-life situations and behavioural management), corresponding to the outcomes of previous studies (e.g., Cilauro, 2015; Haduong, 2016; Niemeyer & Gerber, 2015). In-depth analysis of the quantitative and qualitative pieces of evidence shows that the benefits outweigh the risks of playing MC. However, parents reported three concerns about playing MC: addiction, Internet safety and reducing physical activity. Although these concerns may limit the social advantage of playing MC with others, examining these concerns show that they are related to gaming management rather than MC itself as a game.

Thus, MC can be used as a place for social intervention as no specific mental health concern was reported in this research, and potentially be beneficial for children with ASD as they have social and communication difficulties. By the same token, a robust report by the European Commission concluded (Bleumers et al., 2012, p.157),

> Digital games have the potential to improve social skills and foster communities of practice in which knowledge is shared informally and members feel accepted and respected. For those at risk of social exclusion, this is highly relevant. Being able to interact meaningfully with family or friends and to identify with a cultural group or community and to feel recognized by others is a key part of societal participation. Those who can fall back on a strong social network will also feel supported in engaging in activities they might not feel confident to undertake alone. In essence, all digital games can become the subject of a community of people with shared interests. In some cases, however, this process is reinforced by offering in-game social interaction and through active

community support around the game (e.g. social network games, modding groups, discussion forums).

Although the benefits and detriments of OCG are ongoing debates among scholars as it is related to multiple variables, such as country, gender, type of game …etc. (illustrated in § 3.5), MC is reported to be helpful in developing children's collaboration skills and building social connection and friendships (e.g., Petry, 2018; Hong-An, 2016; Quiring, 2015; Southgate et al., 2018), particularly for children with ASD (Mu & Sin, 2018; Ringland, 2019). However, a number of factors can affect children's ability to achieve joint attention, collaborate, and interact should be taken into further interventions, such as prior social ties, gaming experience, and responsiveness ability to other players (Davis et al., 2018). Overall, online games also, in general, provide opportunities for these types of social interactions (Boyle et al., 2012; Caroux et al., 2015; Cole & Griffiths, 2007; Dezuanni et al., 2015; Lenhart, 2015; Kuhn & Stevens, 2017). These social connection tools are very fundamental for all children, but especially children with ASD or HL, as children without friends report higher rates of loneliness and lower social competence (e.g., Parker & Seal, 1996; Rubin et al., 2015). In this thesis, with its limitations (reported in the following section), it can be concluded that cooperative game play on MC has no significant associations with difficulties on the SDQ for either TD or children with ASD and may be potentially beneficial for children with ASD.

11.3 Limitations of the Research

The current study has produced a comprehensive body of knowledge, by combining both quantitative and qualitative methods, about OCG, and MC in particular, for children with ASD, compared to TD children, as well as children in the UK in comparison to children in KSA. The outcomes of the quantitative examination cannot be fully generalised to a wider population as it used purposive sampling techniques. Previous studies tended to be conducted on one particular group or country (Chapter 4), but this study included a wider comparison of a correlation study design, that

would produce rich comparison from different perspectives. Nevertheless, three main limitations were identified in respect of this thesis.

Firstly, the sample of children with HL in the questionnaire was limited, which limited the researcher from including this group in many statistical tests. It can be observed that there are fewer participants from both countries, which might be due to the fact that the causes for HL have been studied since the eighties and universal newborn hearing screening is applied in most developed countries, allowing early intervention to be implemented (Ching et al., 2017). In addition, there is a high percentage of deaf people who are medically treated and no longer consider themselves as deaf (Smith et al., 2005; Vona et al., 2015) (prevalence of HL can be found in § 1.1.2). Another possible explanation for having lower participation in the HL group is because the AQ-10 was at the beginning of the questionnaire, which may have discouraged some of the participants from completing the questionnaire because they believed it was only for people with ASD.

In order to try to solve these limitations, three actions were undertaken. First, the word 'autism' was deleted from the question title in the second round of data collection and removed from the hard copy that was sent to schools, but this did not increase the number of the sample. Second, attempts were undertaken to combine the two HL groups together. The Mann-Whitney test was undertaken to test the difference between HL participants from both countries, but significant differences were found in the conduct problems score and hyperactivity/ inattention scores; thus, the HL groups could not be combined. The third attempted solution was introduced in the second data collection round, and which was to print out hard copies and distribute them physically to specialist HL and ASD schools. This worked successfully for slightly increasing the sample of ASD children but did not help with the HL sample, as most of the cities had only very few children that met the selection criteria and most of them did not return the questionnaire to the school. The total number of HL schools, organisations and clubs in the UK that were approached (after five attempts at contact) was 87, but only 8.86% of them gave responses, and in the KSA there were 20 HL schools, organisations and clubs, but only five of them gave

responses. Thus, unfortunately, the response rate was very low. Therefore, the HL group was excluded from most of the statistical tests in this study and is, therefore, missing from the main results. Without enough data and information, the study was therefore unable to make comparisons between this group and other condition groups, such as TD or ASD, nor between the two countries. Although this study was conducted with small HL samples, the insights that were gained have the potential to open up further study.

The second limitation is that this study intended to have enough observations and interviews from all condition groups, including children with ASD and HL, from the KSA. However, the researcher was not able to identify any family of a child with ASD or HL who were willing to take part in the observations and the interviews. Although observations and interviews might not be an accessible research method by itself for some children with ASD or HL because of language barriers or sensory sensitivity (Johnson & Christensen, 2012), it becomes even more difficult with cultural and social barriers (Karasz & Singelis, 2009; Sands, Bourjolly & Roer-Strier, 2007; discussed at § 5.6.4). For example, it is challenging to undertake research on children with disabilities in KSA for a number of reasons, such as parents feeling guilty or ashamed for having a child with special needs or those children being "hidden, not diagnosed or do not admit to having the disability" (Mashat et al., 2014, p.428). In addition to cultural sensitivity, some of the participants may have decided not to take part in the observation as they may not have been willing to allow the researcher to video record their children or take part in the interview because it would be audio recorded (e.g., Alzahrani's thesis, 2014; Larsson, 2016), which may make the data less anonymised (Gray, 2014). In addition, undertaking a study from overseas has some limitations (Necib, 2017) that might have affected the data collection for this thesis (for more details, see § 5.6.4). Further, although the study did not take the religious aspect into specific consideration in the investigation, parents, especially in KSA, may not have allowed their children to play in a multiplayer mode due to conservatism and including regarding the interaction between girls and boys (Heble, 2007). Another possible explanation for these limitations could be due to the lack of understanding

of the importance of research and the involvement of children with special needs (Alnemary, 2017; Al-Jadid, 2013; Al-Gain & Al-Abdulwahab, 2002; Gharaibeh, 2009; Hadidi & Al Khateeb, 2015). All these factors can prevent families from participating in any research (further discussion can be found in § 5.6.4). Various suggestions in respect of this are presented in the recommendations section for further research.

The third key limitation of this investigation is related to the design of the questionnaire. Specifically, this relates to three aspects of its design: (1) using the AQ-10 with the KSA sample and for children with HL (as it was validated mainly for TD children with the UK sample); (2) complications encountered in understanding certain points; and (3) its length. All of these may have affected the accuracy of the participants' responses. Regarding the use of AQ-10 with children with HL, the AQ-10 was not used to screen children with HL for suspicion of ASD in this research's sample. Also, in order to control the shortcomings of using the AQ-10 with the KSA sample, the Mann-Whitney Test (§ 5.5.1 and § 6.5) indicated that the AQ-10 scores were not significantly different between the two groups: suspected ASD and the official diagnosis of ASD (p =.40). Thus, the two groups were combined, and then this limitation effect was reduced. Another potential issue related to the participants' ability to understand the questions in the questionnaire, which may require further explanation (Porter, 2011). For example, some of the people met in the first data collection round reported that they did not take the questionnaire because of seeing the AQ-10 at the beginning and that their children did not have ASD, so they decided not to take part in the questionnaire. Although these issues were fixed in the second data collection round, the sample number did not increase very much.

This study used the Convergent Mixed Methods Design where the researcher used quantitative data as the primary scores and used the results of the qualitative data to confirm or disconfirm the quantitative outcomes. Therefore, the researcher placed heavy emphasis on the questionnaire, which resulted in it being very lengthy, with a total of ninety items. Although some parents or guardians had no access to Parts 2, 3 and 4 because their children did not play MC, or it excluded them from Part 3 because their children had not played MC in a multiplayer mode, the questionnaire seemed

to be lengthy for parents with special needs children, as these disabilities caused additional time constraints for the parents. The average time spent filling in the questionnaire by respondents in the two countries and completion percentage rate was low (as reported fully in § 6.2 and § 6.3), despite the fact that the researcher offered a chance of winning an iPad Mini 4 for a randomly selected participant (discussed in the ethical considerations, § 5.6.5). Thus, all these limitations to this investigation are important considerations for future research.

There were also some limitations with research instruments, such as the mixed methods approach which can be complex and costly in terms of time, resources, planning, implementation, data collection and analysis, and in connecting the quantitative and qualitative data together meaningfully (Caruth, 2013; Johnson & Onwuegbuzie, 2004; Porter, 2011). However, it was necessary to overcome some of the limitations of the questionnaires, such as misinterpretation of the questions (Bailey, 1994), not providing an accurate, honest answer (Wyse, 2012), reflecting some of the designers' views of the world (Gray, 2014), not being able to get a response if the respondent forgot to include the question in the questionnaire, or controlling the environment (Bailey, 1994). Thus, the use of the qualitative approach was to overcome some of the shortcomings. In addition, the questionnaires were used to overcome some of the qualitative approach limitations, such as the interview being costly in time and effort, and inconvenience, and impacted by researcher bias (Bailey, 1994; Gray, 2014). Observing behaviours is time-consuming and may be affected by the person knowing they are being observed (Coolican, 2014), or data may be impacted by the observer (Bailey, 1994). One of the possible limitations is that the questionnaire was completed by parents rather than the children themselves, where parents may not have actual knowledge of their children's playing pattern and behaviour or that these responses were driven by social desirability (Vandewater & Lee, 2009). In contrast, some children's ability to answer research surveys accurately might be controversial (Scott, 2008). Thus, the questionnaire was designed and given to parents for the interests of consistency and accuracy across

the whole research sample. Thus, the mixed methods approach was to overcome these difficulties and provide greater research validity.

In this particular study, there was also some inconsistent information between interviewing children and their parents, which mainly related to the heatherton effect on research (i.e., self-esteem effect on responses and the ability to answer questions honestly; Vohs & Heatherton, 2003). For example, a child said that he liked to play with his friends but did not talk about it with them, but his parents said that he does talk about the game to his friends and siblings. Another child said she plays MC, but her parents said she had not played MC and had no access to the game. Another limitation was that a child did not necessarily collaborate very well in the interview. Answers were either very short or on occasions they remained silent, although a possible explanation for this particular child was that her SDQ score for peer relationship problems was 4, which means 'abnormal'. It may be that she is young and does not want to talk to adults or to a male, or because the interview was after the observation, so she may have felt unhappy after she stopped playing for the interview. However, arrangements to avoid these limitations and overcome them are important for any future research.

11.4 Recommendations for Future Research

Following the methodological limitations discussed previously, future research on the impact of OCG, and MC specifically on mental health and academic achievement for children with ASD or HL is needed and would benefit from a focus on, and more in-depth involvement of, children and young people. More structured and systematic studies, such as experimental study, would provide parents, teachers and researchers with more knowledge about the impact of MC on mental health and help them increase desirable outcomes and control those which are undesirable. To be more effective, a shorter version of the self-report survey with clear and straightforward items should be considered with a higher systematic random sample. For example, using the full version of the autism spectrum quotient (AQ) could be used instead of the short version. Cawthon, Fink, Schoffstall and Wendel (2018) noted that the field

of social skills of children with HL has recently shifted the emphasis to the social-emotional learning because it plays a critical role in children's emotional well-being, and because emotional health influences children's social interactions. Providing the study instrument by way of sign language might be one possible recommendation for a further study. Allying with deaf and hard-of-hearing organisations might provide researchers with a higher number of participant engagements. Importantly, developing new and innovative recruitment methods for children with HL and their parents is substantially needed.

As also explained in the limitations, further research needs to include the voice of children with HL, and their parents and teachers, which could be achieved through a national survey of all children with HL in order to obtain a sample appropriate for generalisability. Durkin et al. (2013) also suggested more research on the impact of games on children with ASD and their own perceptions, choices and social potential of gameplay. Academic achievements, such as literacy and mathematics skills of children with HL or ASD, could be taken into consideration when conducting further study to see whether games provide children with more than psychological outcomes in a formal education context (Tsikinas & Xinogalos, 2019). Physical activity should be taken into account when considering future research as some parents are concerned about this factor with their children. This could be a longitudinal correlation study between, for example, the BMI and playing patterns, and the psychological outcomes. A higher number of factors would provide a better understanding of the role games play in children's lives and their development. Additional studies might usefully explore the association between behaviours in online gaming and behaviour in real-world interaction to attend to social learning generalisability.

Future investigations in this area might contain, primarily, a focus on multiplayer gaming experiences by exploring different forms of interaction, including physical and social interaction, bullying within games, and psychological benefits or harassment. Qualitative research is needed for exploring players' experiences, especially individuals with social skills deficiencies in particular forms of interaction and socialisation. How it occurred and developed, how they experienced it, how to cope

with it, and how parents and teachers can provide much needed help, are questions that future studies should attend to. Furthermore, tablets, as forms of technologies, are promising tools for children's involvement in research processes and voice their creativity (Arnott et al., 2016).

Further research in KSA needs to recognise all possible factors that might impact the data collection process and take them into consideration when conducting new research. For example, taking into consideration the impact and effects of other variables and factors such as religion and culture, future studies should account for these, particularly in KSA, and which will provide better data collection processes and outcomes. Using quantitative data collection approaches, future studies can investigate all these factors and explain how they affect social learning through games and related behaviours. Furthermore, by using quantitative data collection approaches in KSA, such studies can overcome some of the data collection difficulties encountered in this research as participants' identities can be hidden to researchers, which may motivate individuals to participate and be contentedly involved with the enquiries. Yet, acknowledging the researchers' identity clearly to participants may solve some of the data collection complications; for example, through clarifying that the researcher holds a scholarship from a recognised institution in KSA and is aiming to help children with special needs in the country.

Although this study explored more than one condition and more than one country for comparison purposes, further exploration with only one condition group is necessary to provide a more in-depth picture of gaming experiences for specific conditions. Finally, but not exhaustively, issues surrounding gaming safety and Internet safety for children with ASD or HL, as well as experiences of being bullied by other players, are urgently needed to be explored. These issues were raised by some parents and require further investigation.

11.5 Recommendations for Future Practice

Since the quantitative analysis and the qualitative examination of the previous chapters reveal that MC has no identified concern for children's mental health, it is

recommended to be used in schools for social and academic intervention. Although this study focuses on the element of the social-emotional outcomes of the game, this is very connected learning and, indeed, important to the school environment. As mentioned earlier in chapters two and three, the social status of children has a significant impact on their attitude toward schools and learning (e.g., Robertson & Miller, 2009). Therefore, schools should be a place where children feel safe, welcomed, and included, and this could happen through following their interest in MC and use the game engagement elements for meaningful learning. Robertson (2015, para. 21) stated,

> Minecraft is an example of a digital space that young learners have situated themselves in, without the intervention of schools. It's a very complex and challenging environment, and they are in control of it. […] There is an intrinsic motivation and desire to be in these educational spaces, without our intervention. This represents a cultural shift, and that's what's really interesting for me.

People tend to prefer what they can engage in (Kirriemuir & McFarlane, 2004); therefore, before designing and implementing digital games, it is important to consider several factors to make the intervention remarkable. Malone (1981) presented a theoretical framework for promoting intrinsic motivation in designing computer games for learning that can be done by the establishment of three aspects, challenge, fantasy, and curiosity. Challenge requires the activities to have uncertain outcomes or hidden information or randomness to certain characters. Fantasy is needed to be usefully included user, and to evoke the mental images of physical objects or social situations, that may not be actually presented. The curiosity can be stimulated when students consider their knowledge are incomplete or inconsistent. Although Malone's (1981) theory of gaming was founded before the explosion of today's technology, it is still valid and very relevant to computer games and the digital culture. Felicia (2011a) also give some important aspects to have meaningful games' interventions in learning. Firstly, the intervention's goals ought to be established, defining the experience the players can draw from the games. The designers should

make a game attractive to the students, so they feel safe, confident and immersed in the learning activity and the game mechanisms, which should match (Felicia, 2011a). However, educational games are different since they encompass mechanisms to track knowledge, trigger necessary interventions, and ensure that they are being learned accordingly, but most of them are connected to a learning management system which assists the instructor by storing the progress of the students by tracking the information and providing assistance where required (Wastiau et al., 2009).

Squire (2011) believes that three main people should contribute to a game's design and implementation: education experts, game designers and subject experts. The involvement of these people will increase the chance of designing effective educational games. Gee (2013) emphasises that participatory learning does not always ensure learning unless players are involved in the design and production of the game. Notably, Bossavit and Parsons (2016) point out the value of involving students with ASD specifically as designers and consumers on their own terms. Designing educational technologies for children with ASD requires a combination of educational and cognitive theories through a three-layered design approach of theory, technology and thoughts, as well as an explanation of how these learning outcomes can be used in real-world contexts (Parsons, 2015; Parsons & Cobb, 2014).

Teachers should be aware that choosing a game to be used in the classroom should be based on the students' needs, the lesson and the accessibility of the game (Abu-Shagga, 2012). Students might have special needs or different levels of cognitive or language abilities. Thus, games should be appropriate for almost all students and suitable for learners regarding age, content, language, learning curve, feedback, creativity, estimated time for completing a task, and considering the additional needs of children with disabilities (Felicia, 2009; Groff et al., 2010). Teachers should simplify a task or advance students' prior knowledge by providing a suitable environment to practise tasks. Finally, teachers should explain to students why they are using the game and the expected outcome (Abu-Shagga, 2012). These digital games should not be the focus of the lesson itself, but a tool to facilitate the learning (Arnott, 2016).

Digital games should provide active and critical learning because learning should involve active participation (Baek & Touati, 2017) alongside simplified lessons (Kirriemuir & McFarlane, 2004; Trybus, 2016). Subsequently, if players learn a new fact or task through digital games, they should be able to practise it when they want (Bebbington & Vellino, 2015). Thus, although some available digital games may not be fully welcomed in an educational setting due to any particular reason, games are different, and some can be modified to be adapting to new situations and environments. There are many types of digital games: simulation games, adventure games, puzzle games, racing games, sports games and shooting games. Digital games can involve flexible features, such as single-player or multi-player (Felicia, 2011a). These features should adapt educational instruments, have pedagogical objectives and test learning or give feedback. Importantly, digital games in education should challenge the learner to perform a task, have a set of rules, be engaging, have a connection to real life, promote social interaction, have a strong plan for alternative options and be simple (Felicia, 2009; Groff et al., 2010; Kuhn & Stevens, 2017).

Teachers and players may be faced with some challenges, such as a connection between the game and the curriculum, integrating the games into the curriculum, finding the appropriateness of the game, managing irrelevant or distracting contact in the game that is not removable, and the difficulty of assessing learning through the games based on traditional assessment methods (Groff et al., 2010). However, it can be argued that most of these challenges could be overcome if lessons were prepared well and if school leaders, parents and children collaborated well with teachers. Teachers would be willing to use games in the classroom even if they have a low level of gaming skills (Wastiau et al., 2009). Consequently, teachers should be supported to have adequate knowledge of the game because they have to deal with it in the classroom, and the more they become an expert in the game, the more the implementation or use of the game will be useful.

In terms of the use for MC specifically, it would be important to re-emphasise the recommendation given by Thorsteinsson and Niculescu (2016), who argued that educators need to be skilled in MC and solve any software technical issues to provide

useful and enjoyable learning through the game. Motschnig et al. (2017) concluded that educators need to be involved in the process of research intervention using MC to share their experience and control the classroom. Quiring (2015) stated that human interaction in MC is no less real or meaningful than that outside the game. Thus, teachers' planning and preparation, as well as support availability, are the most important keys in having a successful implementation for any games for learning.

In respect of avoiding undesirable social-emotional or behavioural outcomes, parents in this research provided some valuable pieces of advice. These included balancing the playing time with other activities and involving the family with the playing or someone online who is cooperating. Using the game as a conversation opener and for talking to other children will raise its social benefits. Using MC as "a tool for behaviour management" and "set rules on timings" that should be explained well to the child would make the playing more useful and manageable. It is also important to ensure Internet safety, such as through playing in "creative" mode and with known others such as friends, relatives or acquaintances. Parents recommended using MC to develop a child's literacy skills, such as through reading some MC books. Parents or teachers could support the child's playing by asking "questions and extending any points to bring in real-world facts and issues". Parents' recommendations should be highly considered as they tend to be the closest people to the children, and their experience is highly significant to new implementations. Vygotsky (1978) highlighted that child development is constrained by different social aspects, including the family's lead in the rule and regulation of the child's gaming activity.

11.6 Conclusion

This concluding chapter has summarised the thesis by reviewing and presenting the main findings. The most essential result to emerge from the data was that MC is not less valuable than other social or entertaining activity that can be used as a place for social intervention as it does not have specific concerns for this research sample, because there were no negative outcomes of playing MC on children's social-emotional and behavioural outcomes, and higher frequency of playing MC with

others is significantly associated with a lower peer relationship problems score for children with ASD in the KSA sample (Table 9.1; § 11.2.3). Parents, furthermore, reported three main benefits of MC on children with ASD or HL: peer relationships and peer support (i.e., a space for social interaction with others), emotional benefits (e.g., enjoyment and being happy), and behaviour benefits (i.e., being calm or relaxed and as a reward for desirable behaviours). Concerns about addiction, safety, and children's physical activity were raised, although presented evidence shows that these concerns are related to gaming management rather than the game itself.

This study has some limitations, which included: the small sample size issue with children with HL, and therefore inability to compare this group with other groups; limited accessibility to observe and interview children with ASD or HL and therefore a restriction on the comparison here; and limitations of the self-report questionnaires (restricted AQ-10, length, and writing feedback). Therefore, recommendations for further studies were offered, which included developing new and innovative recruitment methods for children with HL and their parents, and accommodating for all factors that might influence the data collection process (e.g., cultural, religious or spiritual factors), because the field of social skills of children with HL has just recently become more interested in social-emotional learning (Cawthon et al., 2018) as it is critical to children's well-being and social interactions.

Overall, this thesis can be seen as advancing understanding of the role of OCG, and MC specifically, in social-emotional and behavioural outcomes for children. The outcomes of this thesis cannot make the causal claim that social interaction within the MC leads to psychological well-being. There is, however, a clear association between the constructs. Recommendations for future educational implementations were also presented, which included teachers' preparations for MC use, engagement of students and accessible support for teachers for the MC application with all children.

The evidence provided in this research supports the idea that games are a useful tool for today's children's learning and health. This thesis has helped to understand better how these games can shape and facilitate high-quality social experiences, especially

for children with ASD and HL. Although it is not possible to attribute a causal role for MC on children's social-emotional and behavioural health, the outcomes from this study offer a new perspective on the impact of MC on ASD, HL or TD children. Especially, playing MC was not correlated with any mental health problems. This argument generates three important points to consider when trying to understand the role of MC on mental health and how games shape and contribute to children's social-emotional and behavioural outcomes. First, social interaction games (specifically MC here) are not omnipotent or a deterministic tool that direct children's mental health, particularly in relation to social development and peer relationships, rather they are a tool that can be used in conjunction with other tools. Second, children's experience and outcomes on playing MC is complex and influenced by multiple variables (i.e., gender, cultural …etc.), but it must be concluded that no negative outcomes of playing MC were reported. MC is an open-world format and based on current evidence it can be recommended to incorporate the use of MC with other forms of social learning. And third, MC is one element that has been discussed in many social media and news reports in regarding catching the attention and interests of children with ASD. Thus, it might be implemented in social and academic learning, especially because of the reasons mentioned above. From this, parents, teachers and practitioners could safely construct playful experiences for all children, especially children in isolation, in a way that use favoured games (e.g., MC) as facilitating or contributory tools to enhance social learning in playing with others, rather than working on social skills as the focus of a central activity in itself. The next step in this field would be to improve the research with an iterate focus on the role of playing, and how games can influence children's development.

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APPENDICES

APPENDIX 1: SYSTEMATIC REVIEW (CH.4)

Appendix1_Table 1: Reasons for exclusion

Reason for being excluded			
Did not focus on educational, psychological and sociological research (n= 3)	**Did not met the criteria: published in Scholarly Journals (n=13)**	**Did not focus on Minecraft (n=6)**	**Secondary data source(n= 19)**
1. (Crider & Torrez-Riley, 2017)	1. ("Game on for virtual museum," 2014)	1. (Aronson, 2017)	1. (Abrams & Rowsell, 2017)
2. (Hollett & Ehret, 2015)	2. (Atkinson, 2015)	2. (Bailey, 2016)	2. (Beale et al., 2016)
3. (Demir, Cooke, & Amazeen, 2018)	3. (Breuer, 2012)	3. (Buxó-Lugo, Toscano, & Watson, 2018)	3. (Bos, Wilder, Cook, & O'Donnell, 2014a)
	4. (Goetz, 2017)	4. (Chang et al., 2017)	4. (Bos, Wilder, Cook, & O'Donnell, 2014b)
	5. (Golding, 2017)	5. (Maloney, Roberts, & Caruso, 2018)	5. (Dezuanni, 2018)
	6. (Harron, 2014)	6. (Roberts et al., 2018)	6. (Dodgson, 2017)
	7. (Henderson, 2015)		7. (Ellison, Evans, & Pike, 2016)
	8. (Karsenti & Bugmann, 2017)		8. (Kipnis, 2018)
	9. (Kommers et al., 2017)		9. (Kuhn & Stevens, 2017)
	10. (Rozmarin, 2017)		10. (Lastowka, 2014)
	11. (Sharp, 2017)		11. (MacCallum-Stewart, 2013)
	12. (Short, 2012)		12. (McClay & Dowdall, 2016)
	13. (Short, 2016)		13. (Moberg, 2018)
			14. (Moore, 2018)
			15. (Nebel et al., 2016b)
			16. (O'Sullivan et al., 2017)
			17. (Overby & Jones, 2015)
			18. (Willett, 2015)
			19. Wishart, & Thomas, 2015

APPENDIX 2: RESEARCH METHODOLOGY

STUDY ADVERTS

The Impact of OCG on Mental Health

VOLUNTEERS NEEDED

Parents of Primary School Children Aged 8 or Over

We are interested in the views of parents or guardians. You're invited to participate if

- ❑ Your child has not been diagnosed with any disabilities.

For your participation, you will complete an online questionnaire (20 to 40 minutes).

Participants will be included in a prize selection of an iPad mini 2 Wi-Fi 32GB.

We are interested in the effect of Minecraft on mental health in all children, including how those with autism or hearing loss might benefit.

If you would like to know more, please read the **Participant Information Sheet.**

If you have any questions or need further information, **please contact**

Researcher:
Omar Alawajee
omar.alawajee@strath.ac.uk

Chief Investigator:
Dr Jonathan Delafield-Butt
Jonathan.delafield-butt@strath.ac.uk

Many thanks for your attention,
Omar

The Impact of OCG on Mental Health in Deaf and Hard of Hearing Children

VOLUNTEERS NEEDED

Parents of Primary School Children Aged 8 or Over

We are interested in the views of parents or guardians of children with hearing loss. You're invited to participate if

- ❑ Your child has been diagnosed hearing loss.

For your participation, you will complete an online questionnaire (20 to 40 minutes).

Participants will be included in a prize selection of an iPad mini 2 Wi-Fi 32GB.

We are interested in the effect of Minecraft on mental health in all children, including how those with hearing loss might benefit.

If you would like to know more, please read the **Participant Information Sheet.**

If you have any questions or need further information, **please contact**

Researcher:
Omar Alawajee
omar.alawajee@strath.ac.uk

Chief Investigator:
Dr Jonathan Delafield-Butt
Jonathan.delafield-butt@strath.ac.uk

Many thanks for your attention,
Omar

The Impact of OCG on Mental Health in Children with Autism

VOLUNTEERS NEEDED

Parents of Primary School Children Aged 8 or Over

We are interested in the views of parents or guardians of children with autism. You're invited to participate if

- ❑ Your child has been diagnosed with autism.

For your participation, you will complete an online questionnaire (20 to 40 minutes).

Participants will be included in a prize selection of an iPad mini 2 Wi-Fi 32GB.

We are interested in the effect of Minecraft on mental health in all children, including how those with autism might benefit.

If you would like to know more, please read the **Participant Information Sheet.**

If you have any questions or need further information, **please contact**

Researcher:
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Chief Investigator:
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Many thanks for your attention,
Omar

PARTICIPANT INFORMATION SHEET

THE IMPACT OF MINECRAFT ON RELATIONSHIP SKILLS AND MENTAL HEALTH

(QUESTIONNAIRE)

You are invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take the time to read the following information carefully and discuss it with others if you wish. Please ask me if there is anything that is not clear or if you would like more information. Thank you for reading this.

Introduction:
We are interested in children's health and social challenges, and the unique challenges autism and deafness can bring. This research will explore whether OCG in general, and Minecraft or Autcraft specifically, may have an impact on children's social, emotional, and behavioural development as well as relationship skills.

What is the purpose of this investigation?
This investigation aims to explore parents' or guardians' thoughts on their child playing Minecraft. The study seeks to explore how Minecraft may have an influence on children, and how these games can be used positively for educational purposes and to encourage social relations.

Do you have to take part?
Your participation is voluntary, and you are invited to participate in this study whether your child plays Minecraft/Autcraft or not, or whether your child has autism or hearing loss or not. You are able to withdraw from the study at any point, up until the data is anonymized. If you decide to withdraw from this study, your data will be deleted, and it will not be used. Withdrawal from the study after data is anonymized is not possible since we will no longer be able to identify your responses.

What will you do in the project?
After you choose to participate in this research, you will be asked to fill in a questionnaire about your child that has four sections, which are 1) Autism Spectrum Quotient (AQ-10 Child Version); 2) Social, emotional, behavioural development of your child; 3) OCG and Minecraft playing pattern and history; and 4) General grounded Information about the participant. The complete questionnaire should take around 20-40 minutes to complete; though the exact time will depend on various responses. For this study, you will be asked to fill in the questionnaire. You

can fill in the questionnaire whenever and wherever you like on a computer connected to the internet.

Why have you been invited to take part?
For this questionnaire, we are looking to hear Minecraft/Autcraft experience and thoughts of parents or guardians of children with an official diagnosis of Autism, deafness or hearing loss, and typically developing children.

What are the potential risks to you in taking part?
No harm or risk is expected through participating in this study, and there are no preparatory requirements for taking this questionnaire.

What happens to the information in the project?
After you submit this questionnaire, your data will be completely anonymised, and the questionnaire will be deposited on the University's servers by the investigators for up to 5 years after the completion of this study. Anonymised data will be published and presented in a scientific meeting and literature.
This study will not use information where you can be identified.
The University of Strathclyde is registered with the Information Commissioner's Office who implements the Data Protection Act 1998. All personal data on participants will be processed in accordance with the provisions of the Data Protection Act 1998.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?
If you are happy to be involved in the project, you may click on the informed consent for your responses to be used in this study (though Qualtrics) to confirm this. If you want to receive a brief copy of the research results after the investigation is completed, you may contact researcher or chief investigator; although the research outcomes may take over a year to be ready for reporting.
If you decide you would rather not participate in this study, ignore this invitation and no further contact will be made.

Researcher contact details:

Omar Alawajee
PhD student at the University of Strathclyde
omar.alawajee@strath.ac.uk

Chief Investigator details:

Dr Jonathan Delafield-Butt
Reader in Child Development
Faculty of Humanities and Social Sciences
University of Strathclyde, Lord Hope Building, Room 203
Glasgow, G4 0LT Scotland, U.K.
Tel. +44 (0) 141 444 8053
Jonathan.delafield-butt@strath.ac.uk

This investigation was granted ethical approval by the University of Strathclyde Ethics Committee.
If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed, or further information may be sought from, **please contact**:

Secretary to the University Ethics Committee
Research & Knowledge Exchange Services
University of Strathclyde
Graham Hills Building
50 George Street
Glasgow
G1 1QE
Telephone: 0141 548 3707
Email: ethics@strath.ac.uk

PARTICIPANT INFORMATION SHEET

THE IMPACT OF MINECRAFT ON RELATIONSHIP SKILLS AND MENTAL HEALTH

(INTERVIEW AND OBSERVATION)

You are invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take the time to read the following information carefully and discuss it with others if you wish. Please ask me if there is anything that is not clear or if you would like more information. Thank you for reading this.

Introduction:
We are interested in children's health and social challenges, and the unique challenges autism and deafness can bring. This research will explore whether online computer game in general, and Minecraft or Autcraft Specifically, may have an impact on children's social, emotional, and behavioural development as well as relationship skills.

What is the purpose of this investigation?
This observation and interview aim to explore children's experiences of playing Minecraft, and their parents' or guardians' thoughts on their child gaming activity. The study seeks to explore how Minecraft may have an influence on children, and how these games can be used positively for educational purposes and to encourage social relations.

Do you have to take part?
Your participation is voluntary, and you and your child are invited to participate in this interview and observation regarding your child playing of Minecraft/Autcraft regardless whether your child has autism or hearing loss or not. You are able to withdraw from the study at any point, up until the data is anonymized. If you decide to withdraw from this study, your data will be deleted, and it will not be used. Withdrawal from the study after data is anonymized is not possible since we will no longer be able to identify your responses.

What will you do in the project?
After you choose to participate in this research, your child will be observed and video recorded for 30 minutes, and then you and your child will be interviewed, and interviews will be recorded as well. The interview may last around 30-60 minutes, though the exact time will depend on various responses. For this observation, we are looking to see how your child interacts with other players, such as type and

Length of interaction between players, how this interaction is initiated, and whether the child shows any signs of empathy, openness and awareness of others, and express or showing emotions or feeling signs. One of the parents or guardians needs to be presented during the observation and the interview. For the interview, we are seeking to hear Minecraft/Autcraft experience and thoughts of children who play Minecraft in a multiplayer mode and their parents or guardians.

Why have you been invited to take part?
You are invited to take part in this study because your child has played Minecraft/Autcraft in a multiplayer mode.

What are the potential risks to you in taking part?
No harm or risk is expected through participating in this study, and there are no preparatory requirements for taking this observation and interview. The research does not have to intervene with the child during the observation, so there is a minor chance to be stressed or to disrupt his/her routine on the play. During the interview, the researcher will not ask questions that may stress the child, and the interview will be closed if any sign of stressful behaviours appears.

What happens to the information in the project?
After we finish the observation, you and your child will be interviewed. After the observation, video records will be observed to fill the observation form and for validity and reliability purposes. For the interview, your interview will be transcripted. Your personal data in the interview transcript will be completely anonymised. Anonymised data will be published and presented in a scientific meeting and literature.
The interview transcript and the observation notes will be deposited on the University's servers by the investigators for 5 years after the completion of this study. This study will not use information where you can be identified
The University of Strathclyde is registered with the Information Commissioner's Office who implements the Data Protection Act 1998. All personal data on participants will be processed in accordance with the provisions of the Data Protection Act 1998.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?
If you are happy to be involved in the project, you may sign the informed consent for yourself and your child's participation in this study to confirm this. If you want to

receive a brief copy of the research results after the investigation is completed, you may contact researcher or chief investigator; although the research outcomes may take over a year to be ready for reporting.
If you decide you would rather not participate in this study, ignore this invitation and no further contact will be made.

Researcher contact details:

Omar Alawajee
PhD student at the University of Strathclyde
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Chief Investigator details:

Dr Jonathan Delafield-Butt
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If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed, or further information may be sought from, **please contact**:

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University of Strathclyde
Graham Hills Building
50 George Street
Glasgow
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Telephone: 0141 548 3707
Email: ethics@strath.ac.uk

CONSENT FORM

(INTERVIEW AND OBSERVATION)

The University of Strathclyde, School of Education

THE IMPACT OF MINECRAFT ON RELATIONSHIP SKILLS AND MENTAL HEALTH

- I confirm that I have read and understood the information sheet for the above project and the researcher had answered any queries to my satisfaction.
- I understand that my participation is voluntary and that I am free to withdraw from the project at any time, up to the point of completion, without having to give a reason and without any consequences. If I exercise my right to withdraw, and I do not want my data to be used, any data which have been collected from me will be destroyed.
- I understand that I can withdraw from the study any personal data (i.e. data which identify me personally) at any time.
- I understand that anonymised data (i.e. .data which do not identify me personally) cannot be withdrawn once they have been included in the study.
- I understand that any information recorded in the investigation will remain confidential, and no information that identifies me will be made publicly available.
- I consent to be a participant in the project.
- I consent for my child to be audio recorded for the interview for this project.
- I consent for my child to be video recorded for the observation for this project.
- I consent for my child's video recording or video imaging to be presented or published at scientific meeting and literature.

(PRINT NAME)	
Signature of Participant:	Date:

QUESTIONNAIRE

Section 1: Autism Spectrum Quotient (AQ-10 Child Version)

	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
S/he often notices small sounds when others do not	❍	❍	❍	❍
S/he usually concentrates more on the whole picture, rather than the small details	❍	❍	❍	❍
In a social group, s/he can easily keep track of several different people's conversations	❍	❍	❍	❍
S/he finds it easy to go back and forth between different activities	❍	❍	❍	❍
S/he does not know how to keep a conversation going with his/her peers	❍	❍	❍	❍
S/he is good at social chit-chat	❍	❍	❍	❍
When s/he is read a story, s/he finds it difficult to work out the character's intentions or feelings	❍	❍	❍	❍
When s/he was in preschool, s/he used to enjoy playing games involving pretending with other children	❍	❍	❍	❍
S/he finds it easy to work out what someone is thinking or feeling just by looking at his or her face	❍	❍	❍	❍
S/he finds it hard to make new friends	❍	❍	❍	❍

Section 2: Strength and Difficulties Questionnaire

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour over the last six months or this school year.

	Not true	Somewhat true	Certainly true
Considerate of other people's feelings	❍	❍	❍
Restless, overactive, cannot stay still for long	❍	❍	❍
Often complains of headaches, stomach-aches or sickness	❍	❍	❍
Shares readily with other children (treats, toys, pencils etc.)	❍	❍	❍
Often has temper tantrums or hot tempers	❍	❍	❍
Rather solitary, tends to play alone	❍	❍	❍
Generally obedient, usually does what adults request	❍	❍	❍
Many worries, often seems worried	❍	❍	❍
Helpful if someone is hurt, upset or feeling ill	❍	❍	❍
Constantly fidgeting or squirming	❍	❍	❍
Has at least one good friend	❍	❍	❍
Often fights with other children or bullies them	❍	❍	❍
Often unhappy, down-hearted or tearful	❍	❍	❍
Generally liked by other children	❍	❍	❍
Easily distracted, concentration wanders	❍	❍	❍
Nervous or clingy in new situations, easily loses confidence	❍	❍	❍
Kind to younger children	❍	❍	❍
Often lies or cheats	❍	❍	❍
Picked on or bullied by other children	❍	❍	❍
Often volunteers to help others (parents, teachers, other children)	❍	❍	❍
Thinks things out before acting	❍	❍	❍
Steals from home, school or elsewhere	❍	❍	❍
Gets on better with adults than with other children	❍	❍	❍
Many fears, easily scared	❍	❍	❍
Sees tasks through to the end, good attention span	❍	❍	❍

Section 3: Minecraft playing pattern and history

Part 1: OCG playing pattern and history

Q1.5 Here are some statements about your child physical and online play patterns; you may choose from the scale based on your estimation.

	Always	Often	Sometimes	Rare	Never	Do not know
My child plays alone.	❍	❍	❍	❍	❍	❍
My child likes and prefers to play with other children.	❍	❍	❍	❍	❍	❍
My child develops a good relationship with others through playing, in general.	❍	❍	❍	❍	❍	❍
My child plays OCG.	❍	❍	❍	❍	❍	❍
My child prefers to play computer games rather than physical games.	❍	❍	❍	❍	❍	❍
My child played multiplayer OCG.	❍	❍	❍	❍	❍	❍

…….. End of Block ……..

Part 2: Child's pattern of playing Minecraft in single player mode

Q2.1 Does your child play Minecraft/Autcraft

❍ Yes ❍ No ❍ Do not know

If Yes Is Not Selected, Then Skip To End of Block

Q2.2 How often does your child play Minecraft

❍ Daily ❍ 2-3 times a week ❍ Once a week ❍ Once a month

❍ Once in 6 months or less ❍Do not know

Q2.3 My child has been playing Minecraft for

❍ 1-5 months ❍ 6-11 months ❍ 1 year ❍ 2 years

❍ 3 years or over ❍ Do not know

Q2.4 My child plays Minecraft in a week for
❍ 1-8 hours ❍ 9-16 hours ❍ 17-24 hours ❍ 25-32 hours
❍ 33 hours or over ❍ Do not know

Q2.5 My child plays Minecraft with ….. friends
❍ None ❍ 1-2 ❍ 3-4 ❍ 5-6 ❍ 7 or more
❍ Do not know

Q2.6 My child plays Minecraft with ….. family members
❍ None ❍ 1-2 ❍ 3-4 ❍ 5-6 ❍ 7 or more
❍ Do not know

Q2.7 My child's knowledge of Minecraft is
❍ Very advanced ❍ advanced❍ Intermediate ❍Low
❍ None ❍Do not know

Q2.8 My child's experience of Minecraft is
❍ Very advanced ❍ advanced❍ Intermediate ❍Low
❍ None ❍ Do not know

Q2.9 My child is playing Minecraft in school
❍ Always ❍ Often ❍ Sometimes ❍Rare ❍Never
❍ Do not know

Q2.10 Minecraft seems to be a good game for children who are similar to my child.
❍ Strongly agree❍ Somewhat agree❍ Neither agree nor disagree
❍ Somewhat disagree❍ Strongly disagree

…….. End of Block ……..

Part 3: Child's pattern of playing Minecraft in a multiplayer mode

Q3.1 How often does your child plays Minecraft in multiplayer mode?
❍ Always ❍ Often ❍ Sometimes ❍Rare ❍Never
❍ Do not know

If Never Is Selected, Then Skip To End of Block
OR If Do not know Is Selected, Then Skip To End of Block

Q3.2-6 Child's pattern of playing Minecraft in a multiplayer mode (please choose as applied)

	Always	Often	Sometimes	Rare	Never	Do not know
My child is able to play Minecraft with people whom he/she does not know.	❍	❍	❍	❍	❍	❍
My child develops new relationships with others through Minecraft	❍	❍	❍	❍	❍	❍
My child starts to make connections to his peers after he plays Minecraft in multiplayer mode.	❍	❍	❍	❍	❍	❍
Minecraft develops my child's relationships with others.	❍	❍	❍	❍	❍	❍
My child spends more time playing Minecraft with others over going out with them.	❍	❍	❍	❍	❍	❍

Q3.7 Any comments or thoughts about your child playing Minecraft? (optional)

…….. End of Block ……..

Part 4: Overall impact of Minecraft on the child

Q4.1-7 You may rate how much Minecraft has an impact on your child as following

	Extremely positive	Somewhat positive	Neither positive nor negative	Somewhat negative	Extremely negative
Impact of Minecraft on your child's emotions	❍	❍	❍	❍	❍
Impact of Minecraft on your child's home life	❍	❍	❍	❍	❍
Impact of Minecraft on your child's friendships skills	❍	❍	❍	❍	❍
Impact of Minecraft on your child's peer relationships skills	❍	❍	❍	❍	❍
Impact of Minecraft on your child's classroom learning	❍	❍	❍	❍	❍
Impact of Minecraft on your child's leisure activities	❍	❍	❍	❍	❍
Impact of Minecraft on your child's participation in society and community events (including after school activities)	❍	❍	❍	❍	❍

…….. End of Block ……..

Part 5: Overall impact of other games on the child

Q.5.1 Does your child plays one of these games

❍ Disney Fantasia: Music Evolved ❍ FIFA 16❍ IF…❍ Tetris

❍ Zoo Tycoon❍ Other (please specify)…. _____

Q5.2-8 You may rate how much (*chosen game*)[1] has an impact on your child as following

	Extremely positive	Somewhat positive	Neither positive nor negative	Somewhat negative	Extremely negative
Impact of (*chosen game*) on your child's emotions	❍	❍	❍	❍	❍
Impact of (*chosen game*) on your child's home life	❍	❍	❍	❍	❍
Impact of (*chosen game*) on your child's friendships skills	❍	❍	❍	❍	❍
Impact of (*chosen game*) on your child's peer relationships skills	❍	❍	❍	❍	❍
Impact of (*chosen game*) on your child's classroom learning	❍	❍	❍	❍	❍
Impact of (*chosen game*) on your child's leisure activities	❍	❍	❍	❍	❍
Impact of (*chosen game*) on your child's participation in society and community events (including after school activities)	❍	❍	❍	❍	❍

…….. End of Block ……..

[1] NOTE: Qualtrics is able to replace the (*chosen game*) by the chosen game automatically. For example, if a participant chose the **FIFA 16**, he/she will see this statement "Impact FIFA 16 on your child's emotions".

Section 4: General Information (demographic information)

Q6.1 Child's Name (optional)

Q6.2 Your contact details or email (optional)

Q6.3 Child's Gender
❍ Male
❍ Female

Q6.4 Child's Age *

Q6.5 Your Age (optional)

Q6.6 What is your country? *

Q6.7 What is your Postcode? *

Q6.8 Has your child been diagnosed with *

	Yes	No	Suspected	Do not Know
Autism	❍	❍	❍	❍
Hearing loss	❍	❍	❍	❍

Answer If Kind of Special Needs or disability * Hearing loss Is Selected Or Kind of Special Needs, or disability * Autism and hearing loss (simultaneously) Is Selected
Q6.8.1 The degree of hearing loss (in dB)

Answer If The degree of hearing loss (in dB) Text Response Is Displayed
Q6.8.2 when was your child diagnosed with hearing loss (age or date)

Answer If Kind of Special Needs or disability * Autism and hearing loss (simultaneously) Is Selected OR
Answer If Kind of Special Needs or disability * Autism Is Selected
Q6.8.3 According to DSM-5 Autism Diagnoses Levels of Support, what is your child level
❍ Level 1: “Requiring support”.❍ Level 2: “Requiring substantial support”.
❍ Level 3: “Requiring very substantial support”.❍ Do not know.

Answer If Kind of Special Needs or disability * Autism and hearing loss (simultaneously) Is Selected OR
Answer If Kind of Special Needs or disability * Autism Is Selected

Q6.8.4 When was your child diagnosed with autism (age or date)

Q6.9 Does the family has a relative with ASD or hearing loss
❍ Yes ❍ No

Answer If Does the family has a relative with ASD or hearing loss Yes Is Selected

Q6.9.1 What is his/her relationship to the child?

Q6.10 What is the child educational placement
❍ Full-time integrated with typically developing peers
❍ Part-time integrated with typically developing peers
❍ Special class in a general educational school
❍ Special school ❍ Other (please specify)_____

Q6.11 Are you the child's ….?
❍ Father ❍ Mother ❍ Other (please specify) _____

Q6.12 Which of the following best describes the area you live in
❍ Urban ❍ Suburban ❍ Rural

Q6.13 What is your child's primary gaming platform (select all that apply)
❑ Computer ❑ Xbox ❑ PlayStation ❑ iOS devices
❑ Android devices ❑Other (please specify) _____

Q6.14 Thank you for taking part in this questionnaire. One participant will be selected randomly to receive an iPad mini 2 Wi-Fi 32GB. Could you please provide your details if you wish to be in the prize selection.
❍ Yes ❍ No

Q6.15 Are you interested in receiving a brief copy of this research results after the investigation is completed; although the research outcomes may take over a year to be ready for reporting.
❍ Yes ❍ No

…….. End of Block ……..

Section 5: Further investigations

Answer If Does your child play Minecraft in a multiplayer mode Yes Is Selected

Q6.18 Since your child has played Minecraft in multiplayer mode; you and your child are invited to take part in a case studies research (one-time interview and one observation) to express your perspective of Minecraft. The decision to let your child join, or not to join, is up to you.

❍ Yes (provide contact details)❍ No

If Yes (provide contact details) Is Selected, Then Skip To Please enter your first name and last...

Answer If Does your child play Minecraft in a multiplayer mode No Is Selected Or Does your child play Minecraft in a multiplayer mode Do not know Is Selected

Q6.19 Since your child has NOT played Minecraft in multiplayer mode your child may be invited to take part in one further study (e.g., follow-up questionnaire) to express the impact of Minecraft on his/her social, emotional, and behavioural development. The decision to let your child join, or not to join, is up to you.

❍ Yes (provide contact details)❍ No

If Yes (provide contact details) Is Selected, Then Skip To Please enter your first name and last...

Answer If Does your child play Minecraft/Autcraft No Is Selected Or Does your child play Minecraft/Autcraft Do not know Is Selected

Q6.20 Since your child has NOT played Minecraft, he/she may be invited to take part in one further study (e.g., experiment) to express the impact of Minecraft on his/her social, emotional, and behavioural development. The decision to let your child join, or not to join, is up to you.

❍ Yes (provide contact details)❍ No

If Yes (provide contact details) Is Selected, Then Skip To Please enter your first name and last...

Answer If Since your child has played Minecraft in multiplayer mode, you and your child are invited to take... Yes (provide contact details) Is Selected
Or Since your child has NOT played Minecraft in multiplayer mode your child is invited to take a par... Yes (provide contact details) Is Selected
Or Since your child has NOT played Minecraft, he/she is invited to take a part in one further study... Yes (provide contact details) Is Selected
Or Thank you for taking part in this questionnaire. One participant will be selected randomly t... Yes Is Selected
Or Are you interested in receiving a brief copy of this research results after the investigation is... Yes Is Selected

Q6.21 Please enter your first name and last name in the form below.

Name *

Your email *

Your phone number (optional)

Another contact details (optional)

…….. **End of the Survey** ……..

AUTHORISATION TO RE-USE THE SDQ

Gmail Omar Alawajee <o.awaji@gmail.com>

Re: Complying with SDQ copyright

1 message

Youthinmind <youthinmind@gmail.com> 18 April 2017 at 17:02
To: Omar Alawajee <o.awaji@gmail.com>

Dear Omar,

We have now received your payment and are pleased to authorize you to use the SDQ under the terms of the license (please see below – terms (c) and (e) having been part of your pre-authorization).

I hope all works out well and we will be glad to respond if you have further queries at any point.

Best wishes,

Helena Hamilton

Youthinmind Limited

Licensees pay a small license fee to Youthinmind (currently 10p per SDQ administered).

The conditions of use of the SDQ include:

a) Licensees need to keep track of the exact number of SDQs administered, and be able to justify, if requested, the total that they declare.

b) Licensees pay Youthinmind the license fee at regular intervals: quarterly, 6-monthly or yearly at the Licensee's convenience. The fee is strictly per item, with no reduction for large users. (Since we expect users to save money by using the license, larger users are already advantaged by saving larger amounts of money).

c) The web presentation of the SDQ cannot involve any change in wording and needs to be as close as possible to the standard paper version in appearance – no bright colours, flashing icons etc. This is because changes in presentation can undermine the comparability of SDQ data collected in different ways, making it harder to combine or contrast SDQ data from different studies or clinics. The copyright notice on the paper version also needs to be present on the electronic version. To ensure that these terms are respected, we do need to see and approve of the licensee's proposed online version before you are authorized to use it.

d) The license will be revoked if the SDQ were being used in a way likely to bring it into disrepute.

e) There is a one-off authorization charge of £50 at the time of authorization.

APPENDIX 3: DATA COLLECTION

ETHICAL APPROVAL

Omar Alawajee

From:	Ethics
Sent:	04 April 2017 13:21
To:	Omar Alawajee
Cc:	Jonathan Delafield-Butt; Cristina Costa; Richard Wright; Ethics
Subject:	Approval: UEC16/82: Delafield-Butt/Alawajee: The Impact of Online Computer Games on Mental Health and Relationship Skills of Students with Hearing Difficulties and Autism.
Follow Up Flag:	Follow up
Flag Status:	Flagged

Dear Applicants

ETHICAL AND SPONSORSHIP APPROVAL
UEC16/82: Delafield-Butt/Alawajee: The Impact of Online Computer Games on Mental Health and Relationship Skills of Students with Hearing Difficulties and Autism.

I can confirm that the University Ethics Committee (UEC) has approved this protocol and appropriate insurance cover and sponsorship have now also been confirmed.

I would remind you that the UEC must be informed of any changes you plan to make to the research project, so that it has the opportunity to consider them. Any change of staffing within the research team should be reported to UEC.

The UEC would also expect you to report back on the progress and outcome of your project, with an account of anything which may prompt ethical questions for any similar future project and with anything else that you feel the Committee should know.

Any adverse event that occurs during an investigation must be reported as quickly as possible to UEC and, within the required time frame, to any appropriate external agency.

The University agrees to act as sponsor of the above mentioned project subject to the following conditions:

1. That the project obtains/has and continues to have University/Departmental Ethics Committee approval.

2. That the project is carried out according to the project protocol.

3. That the project continues to be covered by the University's insurance cover.

4. That the Director of Research and Knowledge Exchange Services is immediately notified of any change to the project protocol or circumstances which may affect the University's risk assessment of the project.

5. That the project starts within 12 months of the date of this letter.

As sponsor of the project the University has responsibilities under the Scottish Executive's Research Governance Framework for Health and Community Care. You should ensure you are aware of those responsibilities and that the project is carried out according to the Research Governance Framework.

On behalf of the Committee, I wish you success with this project.

Kind regards
Angelique

Angelique Laverty
Research & Knowledge Exchange Services (RKES)

FIELD TRIP TO KSA APPROVAL

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بشأن تبليغ الكلية بالموافقه على قيام المبتعث عمر العواجي برحلة علمية

سعادة الدكتور/عميد كلية العلوم والآداب بالرس حفظه الله

السلام عليكم ورحمة الله وبركاته ،وبعد

إشارة إلى خطابكم ٥٠٧٥٣٦ وتاريخ ١٤ /٠٦ /١٤٣٨هـ. بشأن طلب قيام مبتعث قسم التربية الخاصة المعيد / عمر بن عبدالعزيز العواجي (٢٦٤٥٣) برحلة علمية إلى المملكة العربية السعودية لجمع البيانات اللازمة لاستكمال دراسة الدكتوراه في التربية الخاصة تخصص – إعاقة سمعية – بجامعة University of Strathclyde Glasgow في بريطانيا لمدة ثلاثة أشهر ابتداء من ٠٨ /١٠/١٤٣٨هـ الموافق ٠٢ /٠٧/٢٠١٧م.

نفيدكم بأنه تم النظر بموضوعه من قبل اللجنة الدائمة للإبتعاث والتدريب بالجامعة في جلستها الثامنة عشر للعام الجامعي ١٤٣٧ /١٤٣٨هـ وانتهى بالموافقة على قيام مبتعث قسم التربية الخاصة بكلية العلوم والآداب بالرس المعيد / عمر بن عبدالعزيز العواجي (٢٦٤٥٣) برحلة علمية إلى المملكة العربية السعودية لجمع البيانات اللازمة لاستكمال دراسة الدكتوراه في التربية الخاصة تخصص – إعاقة سمعية – بجامعة University of Strathclyde Glasgow في بريطانيا لمدة ثلاثة أشهر ابتداء من ٠٨ /١٠ /١٤٣٨هـ الموافق ٠٢ /٠٧ /٢٠١٧م . شريطة أن يباشر الإعداد لبحثه تحت إشراف قسم التربية الخاصة بكلية العلوم والآداب بالرس وأن يقوم القسم بإعداد تقرير وافي عن الرحلة وذلك استناداً إلى الفقرة الخامسة من المادة الخامسة عشرة من لائحة الابتعاث والتدريب لمنسوبي الجامعات.

للإحاطة .. وتبليغ الأستاذ/ عمر بن عبدالعزيز العواجي بموافقة الجامعة على قيامه برحلة علمية إلى المملكة العربية السعودية لمدة ثلاثة أشهر ابتداء من ٠٨ /١٠ /١٤٣٨هـ الموافق ٠٢ /٠٧ /٢٠١٧م.

APPENDIX 4: RESULTS AND FINDINGS

A. Raw statements (parents' qualitative responses in the Questionnaire)

Ref. Number[1]	Country	Condition	Play Type[2]	Age	Gender	Any comments or thoughts about your child playing Minecraft? (optional)
1	UK	ASD	MCM	11	F	It's been such a boon. When she is in shutdown its really helpful for her as a means of tuning out other sensory experiences. Without it, she would be socially isolated and online; there is always someone to play with. She struggles with social interactions and the complexity of conversations, and she really can't read faces or tone of voice so messaging levels the playing field. There is a superficiality about the exchanges that she finds it easier to deal with. I cannot stress enough the positive effect Minecraft has had on her mental health on her dark days. And although initially, she had meltdowns around policing screen time, as she has got older, she has experienced more shutdowns, and Minecraft seems to keep her from totally disconnecting and us huge usefulness to reduce sensory input.
2	UK	ASD	MCM	8	F	She is much more able to communicate through the PC as it allows her time to form a response and check to see if her response is appropriate. She is more comfortable in the online world.
3	UK	ASD	MCM	12	M	can lead to arguments, e.g. if multiplayer and the players start destroying each other worlds. was more of an issue when younger in age
4	UK	ASD	MCM	14	M	He loves it!
5	UK	ASD	MCM	10	M	He pays attention to the construction of simple objects. Would prefer to play with someone online who is cooperating with him
6	UK	ASD	MCM	8	M	My child has been introduced to Minecraft through school, where he plays once a week, especially with his math and science teacher, seems very chatty about it but hasn't asked to play at home.

7	UK	ASD	MCM	11	M	Used in my son’s specialist ASD school for challenging behaviour. I worry it’s too addictive and he spends hours watching YouTube videos of others
8	UK	ASD	MCM	13	M	Allows them free imagination. Very absorbing. Safe
9	UK	ASD	MCM	13	M	Has developed a few friends from school through playing Minecraft but this seems to go in fits and starts. As parents, we are happy that he isn't obsessed and spending too much time playing as he can get a bit irritable when playing if the game doesn't go his way.
10	UK	ASD	MCM	8	M	He enjoys and somewhat obsesses over the game. With many books about the game and merchandise
11	UK	ASD	MCM	12	M	He enjoys online games where he can interact with others, Minecraft and fortnight. But he has an unrealistic expectation of what he thinks his 'friends' expect him to do, in the online game (e.g. he thinks he should start playing online as soon as he gets home, as he thinks his friends expect him to do so).
12	UK	ASD	MCM	14	M	He functions better in the virtual world than he does in the real world 😳 Gaming is the most important thing in his life
13	UK	ASD	MCM	11	M	He interacts online with the same small group of players. Is very engaged in what he is doing, and has learned a lot about cooperation, turn taking, teamwork and strategy. As he is now home educated due to difficulties in mainstream schooling, this is his only source of interaction, chat and laughter with peers.
14	UK	ASD	MCM	12	M	He struggles with social perception, e.g. in a PvP scenario if he loses he often perceives the other had unfair advantage or assistance from others and tends to exhibit unkind behaviours almost in the apprehension of being unable to cope with social demands.
15	UK	ASD	MCM	11	M	I approve of this game. He played it more before discovering Survivalcraft.
16	UK	ASD	MCM	11	M	I find Minecraft educational and a good way of planning things

17	UK	ASD	MCM	13	M	I only know what it is, and it doesn't interest us as a family. I have heard about the benefits to Autistic children and do not have a problem with limited play with friends from school but not strangers.
18	UK	ASD	MCM	10	M	I play it with him, and so does his sister. It has helped with all areas of his life.
19	UK	ASD	MCM	10	M	I think playing the 'creative mode' has helped my son to explain his ideas and negotiate meaning with others - useful pragmatics skills. He likes seeing things materialize on the screen that he has 'created' and explaining to others how he did things and asking questions about their designs. He greatly enjoys taking about Minecraft with his school friends - this gives him common ground with them and enables him to discuss a subject that is relevant to other players (otherwise he focuses conversation on unusual topics/obsessions which alienates him from more general conversations and leaves friends with no response to give to keep a conversation going). We don't allow him to play for more than an hour a day, and we make sure we support his playing by asking him questions and extending any points to bring in real-world facts and issues. We don't allow him to play 'survival mode' as we feel this is too violent for his age-group (age 10) especially given that his emotional intelligence is less than others of his age, and his mental health can be fragile.
20	UK	ASD	MCM	9	F	I worry about the intensity with which my daughter is engaged with Minecraft, almost to the exclusion of the real world around her. She really enjoys it, and I hear her often laughing whilst playing with one particular friend who is also on the spectrum.
21	UK	ASD	MCM	9	M	Is always relaxed and happy when playing. He creates amazing structures often for other people and linked to their lines and dislikes
22	UK	ASD	MCM	9	M	It allows my child to be creative/build structures. He struggles with this in real life due to physical limitations (co-ordination difficulties/poor manual dexterity).
23	UK	ASD	MCM	14	M	It helps with concentration and creativity
24	UK	ASD	MCM	10	M	Plays alongside a friend who is on the other end of FaceTime, so they chat about what they are doing when in the same world

25	UK	ASD	MCM	9	M	Plays too much
26	UK	ASD	MCM	9	F	She used to play PE on the iPad, mostly alone and world creating. She has only recently gone on a server & started playing with other autistic children. She's very excited about it.
27	UK	ASD	MCM	8	M	Still likes them very much, although can play for a while and stop to do something else. Lately he has been asking for more apps that would allow him to make his own little films or cartoons on the computer or create his own games by simple coding.
28	UK	ASD	MCM	14	M	The time spent on a screen device is getting worse, and he has begun watching two devices at once, i.e. iPad (with headphones) and PC. He never wants to go out or do things as a family, and if we do, he clock-watches and complains if he thinks he's going to miss even a minute of his allotted time. His lifestyle is sedentary and controlled by when he can watch tv, next go online or play a game. His current favourite is Kerbal Space Mission, which he argues is educational (teaching him about physics). He can't self-police the time he spends on a device (we limit to 2 hours - twice a day on weekends) and gets angry and shouts if he is asked to get off after this time, saying he was just about to or was just shutting down (it can take an extra 30 mins to do this!).
29	UK	ASD	MCM	9	F	This environment, outside of being at home, is where Ava feels most confident and happy.
30	UK	ASD	MCM	14	M	Used to get upset if something went wrong with his Minecraft 'world', but now doesn't seem bothered and just builds another one.
31	UK	ASD	MCM	8	M	Don't mind as long as it's balanced out with other activities
32	UK	ASD	MCM	11	M	Minecraft occupies him, and he produces remarkable works. It helps his elder sister likes this. We do not let him play online because of the concern of how he would interact with others.
33	UK	ASD	MCM	11	M	My child played a lot of Minecraft 18 months ago - but he now plays far less, probably only in school holidays. He has moved onto other games that he favours more than Minecraft

34	UK	ASD	MCM	10	M	My son has only recently become interested in Minecraft. It provides him with a common interest with his peers. He loves watching Minecraft YouTube videos of other people playing or pop song parodies with a Minecraft theme. He will play Minecraft in turns with a child who comes over once a week, but they do not play online together. My son, at the moment, is not very interested in playing against other children online.
35*	UK	ASD	MCM	11	M	My son is in a support unit for children with Autism
36	UK	ASD	MCM	10	F	She has lots of friends online, including other children with ASD & the peer support she gets for feeling 'different' is huge. She's created a whole world based on her other obsession, Harry Potter, and her friends have helped her, she gets an enormous sense of achievement from this. She told me that roleplays on MC are like a book that you write with other people as you go along. She is hugely invested in these role plays, and they make her incredibly happy. She also has a friend who corrects her spelling and punctuation, so she assured me that she is learning more from MC than she would in school where her sensory processing difficulties and atrocious working memory make it very difficult to take in and retain information. The downside is that she does less IRL creative projects & possibly finds interacting with IRL friends harder, but I think the isolation of being out of school contributes to this anyway, plus the confusions of pre-teen hormones and life changes.
37*	UK	ASD	MCM	8	M	Since starting to play it I have definitely noticed his literacy and numeracy has dramatically improved - he hates learning in general and disliked reading, yet the game requires him to be able to know how much diamond armour for example he has and also means that he needs to be able to read what he has in his stores / armouries. His knowledge about everyday things has also increased - for example, mining and gemstones, and he is much more interested in the world around him. His literacy has also been boosted by having sufficient motivation to read some Minecraft books which have hints / cheats in them, and he has never ever voluntarily picked up a book before getting into Minecraft.

38*	UK	ASD	MCM	14	M	My autistic son, [he] is 14, he attends mainstream school and every other minute is spent gaming He does have a diagnosis from Leeds Autism Diagnostic Service
39	UK	ASD	MCS	14	M	Can become addicted to it, doesn't want to do anything else except this and Roblox, and can get upset if things go wrong, then has to be removed from the laptop.
40	UK	ASD	MCS	8	M	He plays with younger brother, has helped them to bond, and improved his ability to share.
41	UK	ASD	MCS	9	M	I don't think he really has the patience for it. He seems to like faster things to play/watch, and that have commentary alongside.
42	UK	ASD	MCS	10	M	It is one of the few things he enjoys in life
43	UK	ASD	MCS	11	M	It's certainly bridged the conversational gap between ASCs and NTs in many situations; i.e. the autistic thing seems to be popular with the mainstream, and that makes ASC expertise on the matter more valuable than in the days when AS kids did LARPing and Dungeons & Dragons - and got beaten up for it.
44	UK	ASD	MCS	13	F	[she] is as anxious playing computer games as she is in daily life. She is worried about misunderstanding rules, not completing game tasks on time, not completing tasks she has set herself. However, she is more able to work out solutions because of the set parameters and because there are no outside influences (i.e. once she learns the rules they do not change) and she has learned to set herself reasonable targets which have also transferred into target setting in daily life. I think we are lucky in that she has no problem disengaging from gameplay, but this is because she is ultra compliant. She thrives within a rigid framework, and this applies to her playing games too
45	UK	ASD	MCS	10	M	My son will only play in "creative" mode as "survival" he admits it is too stressful, the idea of other players ruining what he's built makes him very anxious.
46	UK	ASD	MCS	12	F	She uses Minecraft to work out what to do in situations that she struggles with

47	UK	ASD	MCS	8	F	The game is immersive and occupies her brain. After playing, she is more likely to be explosive, and it can take some time to reacclimatise her to non-screen-based activities.
48	UK	ASD	MCS	10	M	He is not constructive - prefers the more directed game Terraria. Also "playing" with his brothers consists of inventing and talking through Terraria-type scenarios, rather than "playing" as most children practice it.
49	UK	ASD	MCS	11	M	I do not encourage him to play online as well I am nervous about internet safety
50*	UK	Both	MCM	9	M	[he] plays a lot of computer games, of which Minecraft is just one. He studies YouTube videos of gamers. He is quite an expert and an authority with his younger brother. He will even play computer games with his sister. In the field of gaming, [he] is an expert. It is one area of social involvement where he is an expert. That helps build his confidence as he is an expert. Having said that he has a huge memory for numbers and has cracked a lot of my codes. He has promised not to abuse his knowledge, and I trust him. Whilst personally, gaming seems a huge waste of time, I can see that it is hugely beneficial for [him]. Because I have three disabled children, I work almost exclusively from home on computers. I often puzzle as to the difference between what I do and [his] gaming. The only difference I can really see is that mine make money to pay the bills, whereas his gaming does not (yet). Something I would really love to try is getting [him]to record gaming videos for release on YouTube for securitisation and earning money. My challenge is that I don't have the IT skills to be actually able to set it up.
51*	UK	Both	MCM	8	M	His behaviour and attitude have seemed to improve since discovering and becoming obsessed with Minecraft. He also uses his imagination more in that he often thinks about the world he has built. Minecraft is also a useful parenting tool in that it can be used to motivate him or produce desirable behaviour by using it as a reward or threat of removal / actual removal as a consequence of undesirable behaviour, as it the one thing he really cares about. I think it is also helping his literacy and numerical skills as it requires him to type commands, and everything is constructed by cubes.

						As he is a child who hates spelling or literacy and any curriculum work; the fact that he has to use these skills, even if he requires help to spell words, is a plus.
52*	UK	Both	MCM	11	M	My child absolutely loves this game and is very much motivated by it. I have also noticed that he is significantly more social since playing Minecraft, especially with other children. In particular, as most children play it, it is a good conversation opener, and he likes to talk to other children who are keen on this game, about Minecraft. He also is much less frustrated now that he is obsessed with Minecraft. A year ago, he was still having aggressive meltdowns where he would be violent to adults and other children, and he doesn't do this anymore. Although he started a special school in September, which significantly meets his needs more than mainstream, I still feel that Minecraft has helped his development too. The other way in that Minecraft has helped is that it is also a tool for behaviour management. It is something that he is obsessed about, and consequently, as a parent, I can use this to incentivise good behaviour or to implement a consequence of bad behaviour. For example, a sanction that is really effective is to take away his tablet so that he cannot play Minecraft for breaches of what we have agreed is acceptable behaviour. It also acts as a warning, so that if he is being non-compliant, I can warn that if I have to ask him to do something again, the tablet is going to be taken away. This is usually very effective, and consequently, the more habitual compliance with adult demands becomes, the easier he finds it to do, sort of in a virtuous circle. There are some detractions of his obsession with Minecraft etc., in that he finds it very difficult to come off it or be time-limited, but it is possible to get him to do this, and this is more than outweighed by the benefits it has given him
53	UK	HL	MCM	11	F	I love Minecraft, and it has helped my daughter it a very good game, not just a craft game it involves the family, and we play together to build a rollercoaster or fun fair or houses castles we talk thro plan together. it is an amazing game
54	UK	HL	MCS	10	M	My child enjoys playing computer games

55	UK	TD	MCM	8	F	It keeps my daughter calm and content
56	UK	TD	MCM	9	M	My child has autism, and it seems to be the only thing where he can let loose and be himself without the peer pressure.
57	UK	TD	MCM	9	M	I am often very surprised at the skills involved to build most things my son manages. it is really impressive
58	UK	TD	MCM	13	M	[he] spends a good 10 hours online gaming a day doesn't give any other interests or hobbies.
59*	UK	TD	MCM	9	M	He has gained a good knowledge of different types of minerals
60	UK	TD	MCM	9	M	I only allow my child to play PlayStation at the weekend. He enjoys it, and I feel like it is a good alternative to violent games. It helps them to exercise their imagination.
61	UK	TD	MCM	10	M	I would say my son as in many kids his age change games ... go through phases of new games that come out. Just now it's constant FIFA ... a while back it was constant Minecraft. Doesn't play Minecraft as regularly. Terraria was another game that a lot of kids played for time.
62	UK	TD	MCM	10	M	My son loves the game fortnight. He has been playing it since around December, and I have noticed that he's becoming more irritable. I've made him recognise this and set rules on timings. He already wasn't allowed to play on school days and now has less time at the weekend. It's very difficult for him to get off as other people at the party are still there. I honestly think he could play the whole day; he had dark circles under his eyes when we were snowed in, and I didn't keep an eye on how much he played as much. He does read and play sports too, but I severely dislike the time wasted playing these games. His friends all think I'm so strict as they're allowed on all the time

63	UK	TD	MCM	11	M	Minecraft is very educational for children and could inspire a possible career in architecture I personally believe it is good for kids
64	UK	TD	MCS	10	M	His play pattern impacted his studies. We hardly work with him to finish his homework and study.
65	UK	TD	MCS	8	F	She would play it very often on her iPad, but now she almost stopped playing it due to the new games she finds every now and then.
66	UK	TD	MCS	8	M	When I stop him playing to eat or do something he rejects and sometimes he cries
67*	KSA	ASD	MCM	9	M	Thank you
68*	KSA	ASD	MCS	10	M	There are many other factors contributing to the attachment of children to this game, Minecraft, such as accessing the internet easily with the carries devices that have the game. He has a bigger brother than him, and he helps him to be attractive to the game; being not watched by the parents not identifying play time and its duration.
69*	KSA	ASD	MCS	11	M	I have three children with autism. Here I talked about two cases, and the third is very low functioning. He does not know games and how to use mobile for games and even sports or physical games. He can use bikes, but with help. He is 11 years, and the other cases are 23 and 13 years... I hope to informative for you
70	KSA	ASD	MCS	8	M	My child is autistic, and he likes the game of Minecraft to build air-planes with different designs, and he is creative in it, and I am happy for that, but I am afraid of the design of this game and its colours; and the way to play it is very distracted and tired.
71	KSA	ASD	OCG	13	M	games are a calamity and disaster
72	KSA	HL	MCS	8	F	Good on the one hand and addictive, on the other hand, to a dangerous degree.
73	KSA	TD	MCM	12	M	It helps them to develop planning skills and decisions, making skills and learn English and help them stay at home in front of us.
74	KSA	TD	MCM	8	M	The game causes him a distraction and strong nervousness. I have noticed that he has been jumping all the time involuntarily.

75	KSA	TD	MCM	9	M	Kids who are addicted to PlayStation are terrified and nervous when they want to go to sleep, even with parents. This has to do with the fast visual images displayed through the PlayStation games. Once I turn off the PlayStation during the study time, violent resistance occurs (which reminded me of addicts' clips because he starts hitting the wall), and then he calms down later on
76	KSA	TD	MCM	13	M	Minecraft is entertaining and suitable for those over 15 years old and their times are well scheduled
77	KSA	TD	MCM	14	F	In fact, the game looks nice, and I saw that it helps my daughter to calm down and control her feelings. She neglected the house, I mean, the game took a lot of from her time, and I am not able to adjust her dealings with the game and how much she plays. I think she has become addicted to the game and sometimes she raises her pressure, especially when she plays with someone and sabotages her things or deals with her negatively or aggressively. But in the first and last she plays only with her cousin and her special friends, which means people whom she and I know them, and this is positive and will maintain her behaviour and morals.
78*	KSA	TD	MCM	10	M	I entered the questionnaire based on the first instructions and explanations (you can participate even if you do not have a child with autism or hearing loss), but I was surprised that most of the questions about the existence of a child with autism!!
79	KSA	TD	MCM	9	M	a good game has no effect from my opinion
80	KSA	TD	MCM	14	M	I think this game is boring and useless. It teaches nothing to players.
81	KSA	TD	MCM	9	F	games make my child ADHD
82*	KSA	TD	MCS	11	M	No, Thank you
83	KSA	TD	MCS	8	M	The reason I do not like the game is that the explanations have many inappropriate slangs and expressions that are unsuitable for his age. I used the game with the child as reinforcement in most cases, but the child became addicted to it, and it became a large part of his life, which means he speaks about it when he sits with someone. The other problem is that I do not have knowledge of the game, its

						benefits and its harm. I am surprised that the children of his age are very intrigued by it, and I fear that it will be harmful to him in the distant future. As an example, causing distraction or causing him epilepsy or addiction, I am not an expert, But I almost sure that this game is a secret and I hope to know whether it is really suitable for the child or not?
84	KSA	TD	MCS	10	M	The only thing I'm concerned about his an addiction to the game. In fact, I do not know the game well, but I see them play it, and I feel it makes them addicted. Also, if I stop them playing for the game, they often misbehave and express bad feelings and show negative reactions. The problem I face is that he learns through YouTube and often has very bad words that are not suitable for his moral and his religion; thus, I prevent him from watching these YouTube clips. They learn for the game through YouTube and YouTube is full of bad clips. There are very ugly things and words that contradict the principles of my education for them and our home.
85	KSA	TD	MCS	9	M	At the beginning he was so enthusiastic about the game that he pressed me a lot to buy books about Minecraft, which is available in Jarir, four or three books and bought it all; he is browses them. He is small to read them completely, although he is 9 years old.

[1.] Statement with * are NOT FULLY accounted for in the analysis of the main themes in Ch. 10 (i.e., §10.2, §10.3, and §10.4); i.e., noted in §10.5.
[2.] OCG: online computer game; MCS: MC Single-player; MCM: MC Multiplayer

B. Multinomial Logistic regression to assess relationships with the playing group

This is the full model of what is presented in (§**Error! Reference source not found.**7.3).

Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	264.741			
Final	228.991	35.750	10	.000

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	129.209	104	.048
Deviance	147.588	104	.003

Pseudo R-Square

Cox and Snell	.137
Nagelkerke	.158
McFadden	.073

Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	228.991[a]	.000	0	.
Child's Age	231.669	2.678	2	.262
Country	251.706	22.715	2	.000
Conditions	229.586	.595	4	.964
Child's Gender	238.838	9.847	2	.007

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Parameter Estimates

Playing group[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
MC Single-player	Intercept	-.863	1.128	.585	1	.444			
	Child's Age	.026	.107	.058	1	.809	1.026	.831	1.267
	[Country=1]	.703	.396	3.150	1	.076	2.021	.929	4.393
	[Country=2]	0[b]	.	.	0	.	.	.	.
	[Conditions=1]	-.209	.393	.282	1	.595	.811	.375	1.754
	[Conditions=2]	-.517	.935	.305	1	.580	.596	.095	3.729
	[Conditions=3]	0[b]	.	.	0	.	.	.	.
	[Gender =1]	.384	.453	.720	1	.396	1.469	.604	3.568
	[Gender =2]	0[b]	.	.	0	.	.	.	.
MC Multiplayer	Intercept	-2.321	1.013	5.254	1	.022			
	Child's Age	.134	.092	2.104	1	.147	1.144	.954	1.371
	[Country=1]	1.540	.345	19.871	1	.000	4.665	2.370	9.181
	[Country=2]	0b	.	.	0	.	.	.	.
	[Conditions=1]	-.063	.342	.034	1	.853	.939	.480	1.834
	[Conditions=2]	-.405	.821	.243	1	.622	.667	.133	3.336
	[Conditions=3]	0b	.	.	0	.	.	.	.
	[Gender =1]	1.277	.428	8.886	1	.003	3.587	1.549	8.307
	[Gender =2]	0b	.	.	0	.	.	.	.

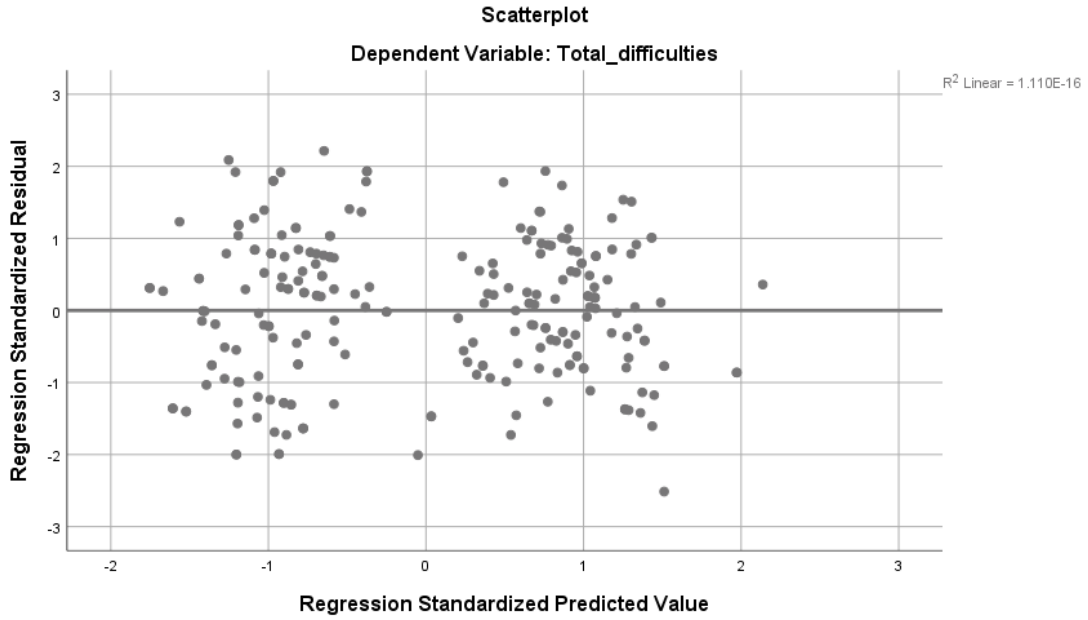
a. The reference category is: OCG.

b. This parameter is set to zero because it is redundant.

Classification

Observed	Predicted			
	OCG	MC Single-player	MC Multiplayer	Percent Correct
OCG	19	0	43	30.6%
MC Single-player	6	0	46	0.0%
MC Multiplayer	12	0	117	90.7%
Overall Percentage	15.2%	0.0%	84.8%	56.0%

C. Multiple regression to predict the score for total difficulties



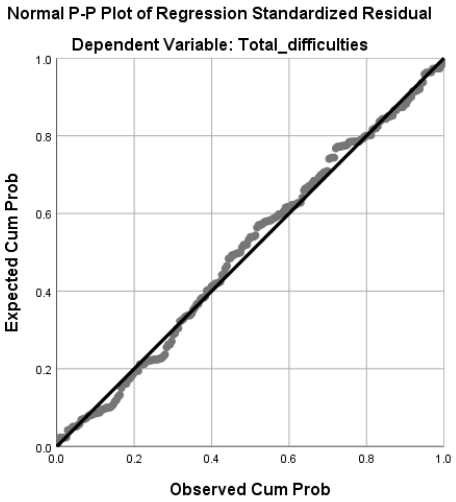
Pearson Correlation

	Total difficulties	Country	Conditions	Child's Gender	Child's Age	Frequency of playing OCG	MC lifetime duration	MC frequency
Total difficulties	1.000							
Country	.034	1.000						
Conditions	-.427	.021	1.000					
Child's Gender	-.041	-.070	.116	1.000				
Child's Age	-.081	-.044	.002	-.078	1.000			
Frequency of playing OCG	.126	-.115	-.228	-.144	.249	1.000		
MC lifetime duration	-.066	-.239	-.062	-.239	.122	.211	1.000	
MC frequency	.092	-.163	-.108	-.066	-.072	.178	.490	1.000
Playing MC with others	-.064	-.271	-.040	-.176	.130	.193	.666	.521

Casewise Diagnostics[a]

Case Number	Std. Residual	Total difficulties	Predicted Value	Residual
133 (in the researcher-made ID; was removed from this analysis)	3.130	39	16.98	22.024

a. Dependent Variable: Total difficulties



This is the full model of what is presented in (§8.3)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.461[a]	.212	.184	6.891	1.877

a. Predictors: (Constant), Playing MC with others, Conditions, Child's Age, Child's Gender, Country, Frequency of playing OCG, MC frequency, MC lifetime duration
b. Dependent Variable: Total difficulties

ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	2839.366	8	354.921	7.474	.000[b]
Residual	10541.595	222	47.485		
Total	13380.961	230			

a. Dependent Variable: Total difficulties
a. Predictors: (Constant), Playing MC with others, Conditions, Child's Age, Child's Gender, Country, the frequency of playing OCG, MC frequency, MC lifetime duration

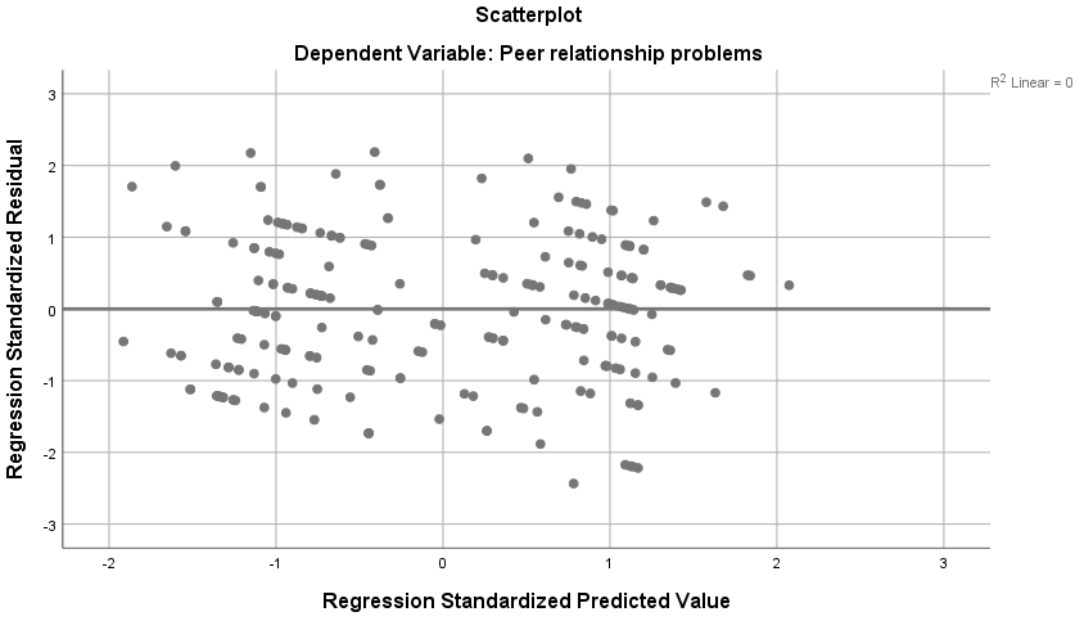
Coefficients[a]

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1 (Constant)	26.582	3.784		7.024	.000		
Country	.298	.958	.020	.311	.756	.898	1.114
Conditions	-3.095	.470	-.407	-6.586	.000	.931	1.074
Child's Gender	-.394	1.263	-.020	-.312	.756	.900	1.111
Child's Age	-.264	.261	-.064	-1.011	.313	.890	1.123

Frequency of playing OCG	.437	.448	.063	.976	.330	.838	1.193
MC lifetime duration	-.415	.322	-.108	-1.286	.200	.502	1.993
MC frequency	.898	.520	.127	1.726	.086	.653	1.531
Playing MC with others	-.384	.426	-.077	-.901	.369	.487	2.055

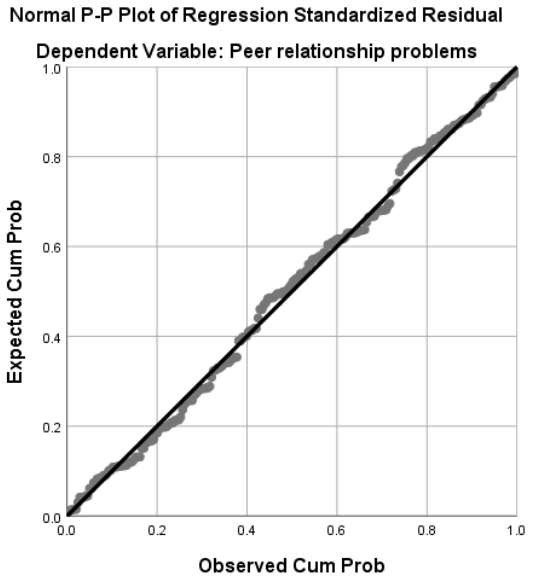
a. Dependent Variable: Total difficulties

D. Multiple regression to predict peer relationship problems score



Pearson Correlation

	Peer relationship problems	Country	Conditions	Child's Gender	Child's Age	Frequency of playing OCG	MC lifetime duration	MC frequency
Peer relationship problems	1.000							
Country	0.074	1.000						
Conditions	-0.457	0.026	1.000					
Child's Gender	0.015	-0.072	0.114	1.000				
Child's Age	-0.046	-0.047	0.000	-0.077	1.000			
Frequency of playing OCG	0.105	-0.109	-0.222	-0.145	0.245	1.000		
MC lifetime duration	-0.009	-0.236	-0.059	-0.240	0.120	0.214	1.000	
MC frequency	0.098	-0.159	-0.104	-0.068	-0.074	0.182	0.491	1.000
Playing MC with others	-0.109	-0.270	-0.040	-0.176	0.130	0.193	0.666	.520



This is the full model of what is presented in (Table 9.2).

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.503[a]	.253	.226	2.284	2.145

a. Predictors: (Constant), Playing MC with others, Conditions, Child's Age, Child's Gender, Country, Frequency of playing OCG, MC frequency, MC lifetime duration

b. Dependent Variable: Peer relationship problems

ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	394.266	8	49.283	9.447	.000[b]
Residual	1163.385	223	5.217		
Total	1557.651	231			

a. Dependent Variable: Peer relationship problems

b. Predictors: (Constant), Playing MC with others, Conditions, Child's Age, Child's Gender, Country, the frequency of playing OCG, MC frequency, MC history

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1 (Constant)	5.963	1.253		4.758	.000		
Country	.372	.317	.072	1.176	.241	.899	1.112

Conditions	-1.167	.155	-.450	-7.523	.000	.935	1.070
Child's Gender	.426	.419	.062	1.017	.310	.899	1.112
Child's Age	-.020	.087	-.014	-.232	.817	.891	1.122
Frequency of playing OCG	.065	.148	.028	.438	.662	.841	1.189
MC lifetime duration	.091	.107	.070	.852	.395	.502	1.994
MC frequency	.339	.172	.141	1.971	.050	.652	1.533
Playing MC with others	-.375	.141	-.220	-2.655	.008	.487	2.052

a. Dependent Variable: Peer relationship problems