The effectiveness of the Lego® therapy intervention in promoting the social interaction of children with Autism Spectrum Condition in the playground: An evaluation study

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I, Yuk Fai Sam Cheng confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Abstract

Social interaction difficulties are one of the main features of Autism Spectrum Condition (ASC), and research has shown that current social interventions may not be sufficient to support the needs of children with ASC in mainstream schools. Lego® therapy involves building Lego® collaboratively in order to promote social interaction for children with ASC. Despite the increasing application of Lego® therapy in educational settings, previous studies were largely clinical in nature; thus, more evidence is required to examine the implementation of Lego® therapy in school settings.

This study employed a mixed method approach to understand the effectiveness of an 8-week Lego® therapy group intervention for children with ASC to improve their social interaction. An additional aim was to explore the impact of having a Typically Developing (TD) child in the Lego® therapy group, further complemented by teaching assistants' views of delivering Lego® therapy in school. Nineteen Key Stage 2 children with ASC and IQs above 70, 4 TD peers and 6 TAs from 5 mainstream primary schools completed the study. A quasi-experimental study divided the sample into 3 groups- pure group, mixed group, and control group. Qualitative data was collected from TAs at post-intervention. In addition, four cases from the pure and mixed groups were selected purposefully for a more in-depth investigation to address variations within the intervention.

Quantitative analysis revealed no significant intervention effects. TA interviews were analysed by thematic analysis and revealed 5 themes which were related to positive changes amongst the participants with ASC, barriers and maintenance factors within the group, benefits of TD peers' participation and practical factors of running the intervention in school.

Implications for Educational Psychologists include working collaboratively with stakeholders in deciding the appropriateness and the length of the intervention and advocating the importance of the environmental factors for successful implementation.

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1. Introduction

This study was completed by the researcher during years 2 and 3 of the Doctorate in Professional, Educational, Child and Adolescent Psychology (DEdPsy) at the UCL, Institute of Education, while working as a Trainee Educational Psychologist (TEP) in a central London Local Authority (LA). Over the course of the DEdPsy, the researcher extended his knowledge of working with children with Autism Spectrum Condition (ASC) and gained more practical experience from his placements within different LAs.

Williams, Higgins and Brayne (2006) illustrated that there is a significant increase in the prevalence of ASC in recent years and also an increase in the number of children with ASC attending mainstream schools. In addition, according to the Department for Education (DfE, 2011), more children with ASC are placed in mainstream schools due to the UK Government's inclusion agenda. Mainstream schools are expected to meet a wide range of special educational needs of children. Although some schools are highly inclusive in their ethos and strive to develop inclusive practice, others continue to find the inclusion of children and young people with ASC challenging, especially in relation to social aspects of their difficulties (Reed & Osborne, 2014). In the past 20 years, the range and number of interventions that support children with ASC with the development of their social skills has increased significantly (Reichow & Volkmar, 2010). The majority of children with ASC had access to a range of social skills interventions,

such as school-based social skills training (Gresham, Sugai & Horner, 2001), behavioural approaches focusing on the reinforcement of appropriate social behaviour (Apple, Billingsley & Schwartz, 2005) **(reference added)**. and peer mediated approaches (Watkins et al., 2015), however, Special Needs Coordinators (SENCos) reported that their students with ASC still showed insufficient ability to play and interact with others in different environments within school (Reed & Osborne, 2014). Furthermore, there is a growing evidence of this population of children experiencing significantly poorer social / emotional outcomes than their typically developing (TD) peers and peers with other developmental needs (Department for Education, 2011). It is suggested that the current social interventions may not be sufficient to meet the social needs of children with ASC (Bellini, Peters, Benner & Hopf, 2007).

The researcher was introduced to a relatively new social intervention, Lego® Therapy, and became interested in finding out more about how it could be offered to schools as a social intervention. Lego® therapy is a collaborative play intervention in which 3 children with ASC are given a specific role to complete a Lego® project collaboratively in a structural setting (LeGoff, 2004). Previous research has shown that Lego® therapy improves participants' social interaction, with reported benefits including an increase in initiation of interaction and duration of communicative exchanges, and a decrease in maladaptive behaviour (LeGoff, 2004; LeGoff & Sherman, 2006; Owens, Granader, Humphrey & Baron-Cohen, 2008). Most importantly, the researchers suggested that skills acquired in Lego® therapy could be generalised to other settings. Lego® therapy has been

promoted and conducted by Speech and Language therapists (SLTs) and sometimes teaching assistants (TAs) in a large number of schools as a social skills intervention in the LA where the researcher is practising (M. Worthington, personal communication, August 6, 2015) **(reference added)**. However, one of the main limitations of previous research into the potential of Lego® therapy is that it is largely clinical in nature and only two studies have been evaluated in a real educational context.

According to the Special Educational Needs and Disability Code of Practice (CoP; DfE, 2015), evidence-based practice is one of the key elements to support children with SEN, and both schools and education professionals are required to draw on the existing evidence-base when supporting interventions in schools. Educational Psychologists (EPs) work collaboratively, usually within a consultative model of service delivery to support schools with the formulation of interventions derived through professional experience and applied practice (Wagner, 2000). In order for EPs to identify and support the delivery of successful interventions, they need to have access to information about evidence-based interventions to support their practice as well as joint consultation with other professionals. Moreover, the social interaction difficulties experienced by children and young people with ASC frequently present a significant barrier to the development of friendships and can impact upon their social, emotional development and overall well-being (Merrell & Gimpel, 2014). There is therefore a need to establish the efficacy of interventions that target / promote the development of social interaction skills. Effective social skills have

long term positive influence on children's school experience and children with well-developed social skills have a lower likelihood of maladaptive behaviour later in life (Merrell & Gimpel, 2014). The nature of collaborative play in Lego® therapy may potentially have the capacity to enhance participants' social interaction in the school setting, especially in the playground. The researcher therefore advocated further investigation of the effectiveness of Lego® therapy in school contexts.

Before joining the DEdPsy course, the researcher was an applied behavioural analysis (ABA) therapist for children with ASC in his home country for 4 years. From the researcher's previous experience as an ABA therapist, there may be the potential for children with ASC to practise and enhance their social skills significantly through playing with typically developing (TD) peers. Such opportunities have been shown to be the key element to generalising the acquired skills for children with ASC (Roger, 2000). In addition, the researcher hypothesised that including a TD participant in the Lego® therapy may potentially offer a more natural environment which replicates the experience during play time in the playground more closely. Therefore, this study was undertaken with the addition of TD participant in some Lego® therapy groups.

Both professional experience and personal interest in the area led to the investigation into the potential of Lego® therapy for children with ASC, in fulfilment of the requirements of the DEdPsy at UCL, Institute of Education.

2. Literature review:

2.1. Chapter introduction:

This chapter will outline some of the main research literature in relation to the areas of focus for this study. It will start broadly by providing an overview of how ASC is diagnosed in children, its prevalence within the community and the needs of children in this population. Then, it will provide an examination of the literature relating to cognitive theories of ASC and how these affect social interaction. It will then consider educational provision for children with ASC and illustrate how deficits in social interaction affect their social life in school. It will provide an overview of school-based intervention and peer mediated intervention with an examination of the inclusion of TD peers. The final part of the literature review will look more specifically at the theories and research relating to Lego® therapy followed by the rationale for the current research.

2.2. Inclusion criteria of Studies for Literature Review:

A systematic review of previous research in the area of social interaction in children with ASC was conducted. In order to review the most recent research within the area, searches were made of journal data bases. A range of databases were used including ERIC, PsycINFO, the web of knowledge and Google Scholar. Keywords were used within the search criteria so that published literature around the area of interest was included. In order to identify journals which included articles on children with ASC the following key words were entered: ASC; ASD; autism; high functioning autism; to include articles about Lego® therapy the

following key words were searched: Lego® therapy; Lego® Club. Finally, in order to include articles about social interaction the following key words were inserted: Social interaction, Social interaction intervention; School-based social intervention; Peer mediated intervention. Searches were carried out between April 2015 and January 2016.

2.3. Overview of Autism Spectrum Conditions:

In this thesis, ASC is used to describe all conditions which fall under this umbrella term. ASC is chosen instead of Autism Spectrum Disorder. The first reason for this choice is that the term 'condition' is considered to recognise a wide range of children with related strengths and needs without individuals being labelled as 'disordered'. Secondly, the majority of journals and other references are still using different sub-categories, such as high-functioning autism and Asperger's syndrome. In order to reduce confusion and ambiguity of different sub-categories, ASC will be used to include the range of sub-categories. During discussion of related literature in later sections of the research, if the children's specific needs are related to the sub-category, then the diagnostic terms will be specified.

The National Autistic Society (NAS, 2015) defined Autism as, "a lifelong developmental disability that affects the way a person communicates and relates to people around them." UK census figures show that there were over 695,000 individuals with ASC in the UK in 2011, which was an estimated 1.1% of the population (ONS, 2011). Studies also show that the prevalence has increased in recent years, and have suggested that the increasing prevalence may have been

caused by the changes in diagnostic methods (King & Bearman, 2009), which leads to better screening and more awareness of ASC (Matson & Kozlowski, 2011).

ASC is regarded as a neurodevelopmental disorder (Frith, 2003), however, no neurological assessments have been shown to assess and diagnose ASC reliably. The Diagnostic Statistical Manual of Mental Disorders fifth edition (DSM-V; APA, 2013) is widely used as a guideline to diagnose autism in research and clinical practice. DSM-V made some major changes to the diagnostic criteria of Autism Spectrum Disorder from DSM-IV. The triad of impairments in DSM-IV has now been replaced with difficulties in two main areas: 1. social communication and social interaction; 2. restricted, repetitive patterns of behaviour, interests or activities including sensory difficulties. Moreover, DSM-V has removed sub-diagnoses, such as Asperger's Disorder and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS), and has instead renamed Autistic Disorder 'Autism Spectrum Disorder' and specified levels of severity in relation to the support required by the individual receiving a diagnosis (APA, 2013).

Behavioural assessments have been used to diagnose ASC. These behavioural assessments focus on the child's social interaction, communication behaviours and developmental history in a controlled or naturalistic environment. One of the core difficulties listed in DSM-V is a persistent difficulty with social communication and social interaction.

2.3.1. Persistent difficulties in social communication & social interaction:

Persistent deficits in social communication and social interaction are one of the two core criteria for an ASC diagnosis. This criterion can be divided into three sub-criteria; 1. Individuals with ASC display deficits in social-emotional reciprocity including limited turn-taking, reduced sharing of interests, problems with initiating or responding to social interactions; 2. Deficits in nonverbal communicative behaviours used for social interaction, such as body language, gestures and facial expression; 3. Deficits in developing, maintaining and understanding relationships, such as building up friendships and sharing imaginative play. Social interaction of children with ASC is of the most interest in the current study. Further understanding of social communication and interaction difficulties need to be established so that appropriate intervention can be provided for children with ASC, thus the following sections describe the cognitive theories underpinning ASC, especially in relation to impairments of social interaction.

2.4. Cognitive theories underpinning the social interaction impairment of children with ASC:

Currently, there is no universally recognised and comprehensive explanation for the cause of ASC. There are numerous theories from the fields of genetics, neurology and cognitive psychology to explain ASC, but no single theory has been found to explain all the features of children with ASC. Given that social interaction is an area of interest in this study, the section below will illustrate explanations related to “Theory of Mind” and “Executive Dysfunction” as the main explanations for the social interaction difficulties of children with ASC. The weak

central coherence theory is not included as there is limited research on this area in relation to social interaction.

2.4.1. Theory of Mind:

Theory of Mind (ToM) is the ability to understand the mental states (thoughts, emotions, beliefs and desires) of oneself and others (Baron-Cohen, 1995). Baron-Cohen, Leslie and Frith's (1985) study involved asking children with ASC, Down's syndrome and TD children to complete the Sally-Anne 'false-belief' task. Anne (a doll) moved Sally's (another doll) marble to the box from the basket where Sally initially put it, while she was absent and unable to see the marble being moved. More than 80% of TD children and children with Down's syndrome responded correctly when they were asked, 'where will Sally look for her marble?' indicating that these two groups of children understood that Sally would look in the basket. However, only 20% of the ASC group answered correctly.

The Sally-Ann task is reported to demonstrate that individuals with ASC are less able to take the perspective of another person, suggesting that individuals with ASC are less able to predict the behaviour of other people, leading to difficulties in social situations. Doherty (2009) proposed that ToM allows children to predict behaviour by understanding the desires of an individual. The delay in development of ToM causes difficulties for children in this population with identifying mental states. As a result, they may have difficulties interacting with others because of the inaccurate prediction of others' thoughts and emotions.

2.4.2. Executive Dysfunction:

The ability to plan, organise, monitor, respond accordingly to change, inhibit inappropriate responses and control attention are referred to as executive function (EF; Rajendran & Mitchell, 2007). Frith (2003) proposed that EF is a crucial ability when an individual is performing new skills or adapting to a change of routine. When individuals are working on more than one task simultaneously, a high level of EF is required. Children with ASC have difficulties in planning, organising and making flexible changes in their plans, which Frith (2003) referred to as Executive Dysfunction (ED). Pellicano (2012) stated that the rigidity and resistance to change in children with ASC are caused by their ED. EF is related to social interaction because when someone responds to an interaction, they need to perceive and evaluate immediate outcomes (Barkley, 2001). Individuals will predict the interaction from their past experience and internalise a response before reacting, and these processes require the use of EF skills. Therefore, it has been suggested that ED not only causes children with ASC to be resistant to change but also affects their ability to plan, predict and formulate their initiation and response to social interaction.

Social interaction is defined as a social exchange between two or more parties, which involves an initiation and response interchange between the parties (Kaczmarek, 2002). A range of skills are required to initiate, maintain and respond in a successful interaction. According to Taubman, Leaf and McEachin (2011), there are 3 levels of social interaction skills: 1. Basic skills include listening to others and responding to their initiations, turn-taking, basic play

participation; 2. Intermediate skills include initiating, maintaining play interaction, responding to cues and interactional reciprocity; 3. Advanced skills include problem solving, helping assertion and decision making. The authors also state that all these skills need to be planned and adequate ToM and EF from the individuals are required to organise their actions and thoughts so that social exchange can be successful. Moreover, the items above are not exhaustive, suggesting that for children to engage in a successful interaction several skills are required simultaneously.

The ability to initiate and respond within social interaction is the first step to developing social skills. Adequate social skills could also be described as vital 'survival skills', as it has been shown that effective social skills have long term positive influence on children's school experience, such as reduced peer victimisation, more positive perceptions of school and higher academic performance, and children with well-developed social skills have a lower likelihood of maladaptive behaviour later in life (Merrell & Gimpel, 2014). Overall, the theories of ASC described above indicate some of the cognitive processes which underlie the heightened risk of difficulties with social interaction. The school setting is full of opportunity for social interaction and social development. However, it is also a place where children with ASC experience a high level of challenge due to their social difficulties. The following section illustrates educational provision for children with ASC.

2.5. Educational provision for children with ASC:

In the past twenty years the educational provision for children with ASC has changed dramatically due to Government funded reviews and research (Clark, Browne, Boardman, Hewitt & Light, 2014). The inclusion of children with ASC across the UK within mainstream school settings has been emphasised by the Department for Education (DfE, 2011). As a result, the number of children with ASC attending mainstream schools has increased significantly (Williams et al., 2006). According to the Department for Education (2011), children with ASC make up a disproportionally large group amongst children with statements of SEN or Educational Health Care Plans. The report also stated that almost two thirds of children with ASC in England were attending mainstream primary or secondary school.

School is one of the few situations that require children to have consistent and intense social interactions with their peers as group work and team play is often required in educational settings. One of the rationales for placing children with ASC in mainstream schools is to increase their exposure to TD children and typical interaction patterns (Waltz, 2013). However, research has suggested that exposure to TD peers does not necessarily result in interaction with those peers for children with ASC. Anderson, Moore, Godfrey and Fletcher-Flinn (2004) observed primary school age children with ASC in the playground and found that they were primarily in solitary play activities even when they were in a crowed playground with the presence of their classmates.

Ashburner, Ziviani and Roger (2010) examined whether educational provision in mainstream schools for children with ASC was sufficient to meet their needs. A comparison of educational attainment between children with ASC and their TD peers was conducted by using the Kaufman Brief Test (Kaufman & Kaufman, 1990). The researchers found that 52% of children with ASC were underperforming and in contrast, only 8% of TD peers showed similar levels of underperformance. In addition, children with ASC were found to show higher levels of emotional and behavioural difficulties than their TD peers. The children with ASC in the study were receiving a range of professional support, such as input from SLTs and occupational therapists. This finding indicates that children with ASC may not always receive the appropriate support or that additional provision should be provided to enhance their educational achievement as well as emotional well-being (Ashburner et al. 2010).

Educational underachievement is not the only challenge that children with ASC may experience. Children with ASC are also at risk of exclusion (Department for Children, Schools and Families, 2009; Humphrey & Lewis, 2008). Teaching staff are sometimes not aware of the social interaction and communication difficulties of this group of children. Some children with ASC may find the school environment challenging and have difficulty engaging both socially and with the demands of the curriculum (Humphrey & Lewis, 2008). This can, in turn, lead to behaviours which school staff find difficult to deal with. Children with ASC may be given temporary exclusions by the school because of their challenging behaviours without taking into consideration their social difficulties (Humphrey &

Symes, 2013). Humphrey and Lewis (2008) suggest that children should receive social interaction and communication intervention in order to support their adaption into the school environment. The authors also suggest that additional training should be given to school staff in understanding the social interactions and communication difficulties of children with ASC.

The researcher believes that not every child with ASC needs additional support to meet their needs in school. However, evidence show that those children with ASC who require help may not be supported effectively by the current educational provision. Despite a range of professional support being available, children with ASC are still found to be at risk of underperformance in social and educational aspects when compared to their peers (Humphrey & Lewis, 2008). This suggests that the current provision may not be meeting their needs and alternative strategies and interventions should be considered. While considering possible alternative interventions, it is important to take the difficulties children with ASC face into account, particularly in relation to social interaction difficulties. By doing so, a clear rationale will be created as what specific area of difficulty the intervention is trying to address and the way it is attempting to support it.

2.6. Social interaction in children with ASC: implications for successful inclusion in mainstream provision

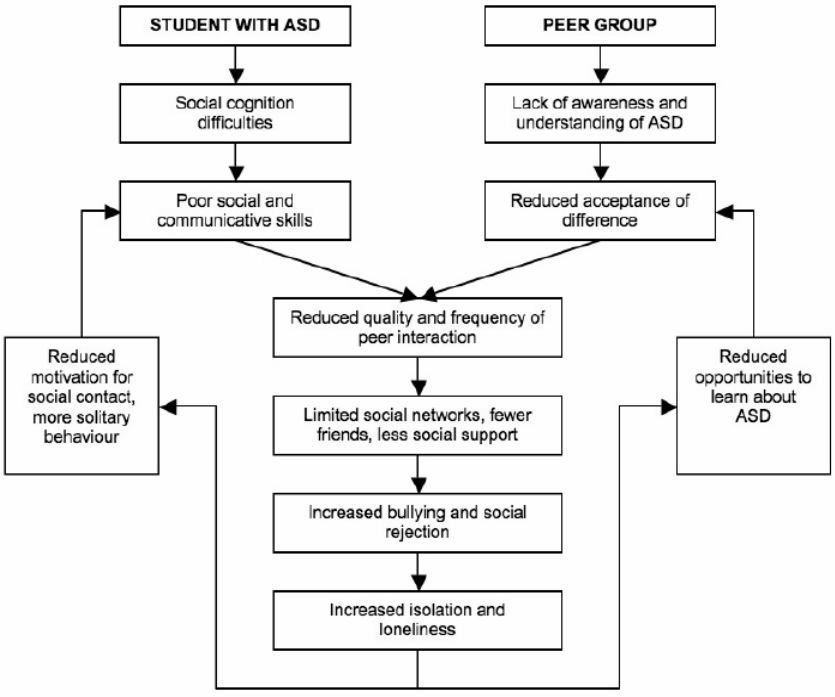
Due to the range of ASC features described above, and particularly the social deficits highlighted, one can make a good explanation as to why children with ASC may experience difficulty coping in schools. Day to day interactions with other children can be challenging for children with ASC. Insufficient skills to

interact socially can provoke negative responses and evaluative judgements by peers and teachers (Merrell & Gimpel, 2014). Inadequate social interaction skills weaken the ability of individuals with ASC to make, build and maintain friendships, and solve social challenges in different contexts, such as bullying, teasing or conflicts. In addition, studies have shown that children with a more visible need appear to receive higher level of empathy from TD peers when compared to children with ASC (White, Scahill, Klin, Koenig, and Volkmar, 2007). Children with ASC who attend mainstream schools have been shown to experience negative social outcomes including narrower friendship networks (Chamberlain, Kasari and Rotherham-Fuller, 2007), lower levels of social support and are more likely to be bullied (Humphrey & Symes, 2010). The likelihood of victimisation of children with ASC does not vary by school placement (Rowley et al., 2012), which indicates that strategies are required to support their social interaction skills in mainstream school and special provision.

Humphrey and Symes (2011) created the reciprocal effects peer interaction model (REPIM) to explain how endogenous and exogenous factors influence the quality and quantity of social interaction between children with ASC and their peers in school (Figure 1 shows the REPIM model). Given that children with ASC are more likely to encounter negative social experience, this may reduce their motivation to participate in social situations. Humphrey and Symes (2011) proposed that this results in a pattern of solitary behaviour which reduces the opportunity to enhance the individual's social interaction and communication skills. Although children with ASC may not learn social interaction and

communication skills simply through observational learning, avoidance of social situations will further reduce their motivation to interact and increase the chances of negative social experience. This may serve as a barrier to motivating children with ASC to experience social interactions in different contexts, thus their opportunity to observe and practise social skills may be reduced significantly. On the other hand, individuals within the peer group may lack awareness and understanding of children with ASC, resulting in lower level of acceptance of difference. This, again, may fuel a reduction in the quality and frequency of social interaction with children with ASC. Children with ASC may therefore be caught in a vicious circle of social isolation (Bauminger, 2002). The REPIM provides a framework for understanding the endogenous and exogenous factors influencing social interaction between children with ASC and their peers.

Figure 1 The reciprocal effects peer interaction model (REPIM; Humphrey & Symes, 2011)



Given the extensive understanding of how and why children with ASC struggle to interact effectively with their peers in mainstream schools, there is therefore a need for effective targeted intervention to promote social interactions skills. The model above also suggested that TD peers may need support to understand peers with ASC as their lack of awareness can lead to rejection of peers with ASC which in turn reinforces peer isolation. TD peers have significant role in helping children with ASC to experience positive peer interaction. The following section reviews social skills interventions. The studies reviewed are not exhaustive. Interventions selected for discussion here are school-based and peer focused, due to their similarities with the Lego® therapy evaluated in current study.

2.7. Review of social interventions:

Interventions relevant to children with ASC across the education and psychology fields have been studied and evaluated extensively (Bellini et al., 2007; Watkins et al., 2015). However, one of the major criticisms in existing reviews of interventions is the insufficiency of evidence of having a consistent positive effect and limited generalisation (Bellini et al., 2007). Moreover, Mills and Marchant's (2011) systematic review concludes that only a few of interventions have a solid research base, thus there is an on-going lack of clarity for educators when selecting appropriate interventions.

2.7.1. School-based social skills intervention:

School-based social skills interventions aim to promote and develop skills in social interaction for children with ASC. Interventions often target social interaction skills, such as initiating, listening and providing a response. Some

programmes introduce the techniques of engaging in small talk and ways of engaging in more in-depth social interactions (Grandin & Barron, 2005). When social skills interventions are effective, there should be significant improvements in specific social aspects, such as social interaction and a reduction in inappropriate behaviours (Bellini et al., 2007). There are several intervention methods aimed at increasing the social interaction of ASC students and their peers: promoting social interaction by using TD peers, explicitly creating social rules for the student with ASC to follow, using reinforcement to encourage attempts at conversational exchanges with these children; specifying the elements and rationale of the social skills activity (Gillis & Butler, 2007; White et al., 2007).

Tse, Strulovitch, Tagalakis, Linyan and Fombonne (2007) examined a school-based social intervention which aimed to promote social interaction for children with ASC. They conducted a pre and post design evaluation of a twelve-session for 46 students with ASC in Key stage 3. Participants with ASC were separated into seven groups in their study. The intervention consisted of a one-hour teaching session focusing on a range of social skills, such as initiating, responding and maintaining conversation, awareness and identification of feelings, eye contact, non-verbal communication; and social rules. Participants' characteristics, such as cognitive ability, were not assessed and it was difficult for the researchers to determine the homogeneity of the sample (Tse et al., 2007). Three sets of outcome measures were used to evaluate the effectiveness of the intervention, however these measures were all parent-report questionnaires:

Social Responsiveness Scale (SRS), Aberrant Behaviour Checklist (ABC) and the Nisonger Child Behaviour Rating Form (N-CBRF) (Constantnio & Gruber, 2005; Aman, Stewart & Field, 1985; Aman, Tasse, Rojahn & Hammer, 1996 cited in Tse et al., 2007, p.1965). Significant improvements were shown across all subtests of the ABC, all except one subtests of the N-CBRF and half of the 12 subtests of the SRS. Although the results were seemingly positive, reliance on parent-report questionnaires as the only type of outcome measure limited the degree to which the results could be considered representative of positive change. The parents' perceptions of their child were potentially altered as their child was attending an intervention. In addition, a control group was not included in the design. Despite these limitations, the positive outcomes indicated that some of the learnt skills may have generalised to the home setting. Programme fidelity was not included in Tse et al.'s (2007) study and an intervention manual was not developed, which may have affected programme consistency across their experimental groups. Despite the age group of the sample in Tse et al.'s (2007) study being different from the current study, there were several reasons for including Tse et al.'s (2007) study. Firstly, the absence of intervention fidelity in Tse's study highlighted the importance of this factor in the experimental design of the current study. Secondly, Tse et al.'s study included seven groups to investigate the social skills intervention in school setting which shared similar design to the current study. Finally, in Tse et al.'s (2007) study targeted social interaction specifically as is the case in the current study.

Intervention fidelity measures whether the intervention is implemented as intended (Beilline et al., 2007). Gresham et al. (2001) concluded in their review that intervention fidelity is often missing in research literature related to social skills interventions. Intervention fidelity data provides insight about the consistency of the programme and it could also provide explanatory information about the ineffectiveness of a social skills intervention whether it is "because of an ineffectual intervention or because the strategy was poorly implemented (Beilline et al., 2007, p. 161)". Poor quality of intervention fidelity may weaken the outcomes of the social skills intervention significantly; therefore it is important to include fidelity measures when evaluating an intervention.

The main advantage of implementing school-based social skills groups is that there is a high degree of flexibility for the school to adapt the training to the local context, i.e. the number and duration of the sessions can be varied depending on the needs of the group. Although such interventions are used widely in schools, in Bellini et al.'s (2007) review of 55 studies, it was suggested that social skills training for children with ASC was not effective at promoting reciprocal interaction with their peers. Moreover, Rao, Beidel and Murray (2008) reviewed ten social skills training interventions for children with ASC and reached similar conclusion as Bellini et al.'s (2007) review. Rao et al. (2008) showed that seven out of the ten studies showed positive outcomes. However, some of the studies with positive outcomes were shown in a subset of subjects or outcome measures only (Sansosti & Powell-Smith, 2006 cited in Rao et al., 2008, p.358), therefore the overall effectiveness was questionable. Rao et al. (2008) also highlighted the

lack of control group in these studies, since only two of the reviewed studies employed a comparative group design. It was difficult to determine whether "a specific intervention is more efficacious than mere clinical attention, or is relevant for the general population of children with ASC (Rao et al., 2008, p.358)". This uncertain outcome led to an alternative approach to supporting children with ASC with their social interaction. Kamp et al. (2002) proposed that social skills do not improve simply by teaching, asserting that children with ASC need exposure to other peers in order to practise. In addition, including other peers may also enhance social interaction and skills generalisation. Peer mediated intervention has been developed to address these limitations and evaluations of a number of studies have been carried out.

2.7.2. Peer mediated interventions:

Bauminger et al. (2003) emphasised that due to the lack of interpersonal and positive interaction with peers in children with ASC, social skills interventions needs to include the participation of TD peers. Peer mediated intervention (PMI) has an extensive evidence base for social interventions for children with ASC. Humphrey and Symes, (2011) suggested that, although children with ASC may make fewer social initiations, respond less to others' initiations and conduct shorter bursts of interactions, on occasion they do participate in social interactions with their TD peers. However, as already noted above, simply exposing children with ASC to TD peers does not produce an increase in social interaction (Laushey & Heflin, 2000). Hence, peer-mediated approaches have focused on having TD peers facilitate social learning in children with ASC

(DiSalvo & Oswald, 2002). According to social cognitive theory (Bandura, 1997), TD peers' expectations of the pupil with ASC change through the training and the experience of interacting with the peer with ASC, and therefore that leads to more effort to interact with pupils with ASC. TD peers try harder to model appropriate behaviour in order to help children with ASC to learn appropriate social skills from them (DiSalvo & Oswald, 2002). According to several researchers (Hwang & Hughes, 2000; McConnell, 2002; Rogers, 2000), PMIs have shown a significant increase in the number of social interactions between children with disabilities, including ASC, and TD peers.

Koegel, Vernon, Koegel, Koegel and Paullin (2013) introduced a PMI that incorporated activities which children with ASC have strong interest in. Three primary school age children with ASC participated in the study. Participants and their parents were interviewed prior to the intervention in order to create a social club with their favourite activity. TD peers were recruited from the same year group and additional training was not provided. There were 6 to 8 TD peers in each social club. The social clubs were carried out in school during lunch time and each session lasted for 30mins every day for 25 days. A trained adult facilitated each session and designed interactive games and questions for the children in the social club. A case studies design was conducted and the authors collected the frequency of initiation and response of social interaction during lunch time. Results revealed that all three participants with ASC showed a significant increase in the frequency of initiation and response within social interaction. Despite the positive outcomes, there were a few limitations which

reduced the strength of the study. First of all, observational data was only collected during the social club period and the researchers did not attempt to measure social interaction in other contexts, such as the playground. The generalisability of the intervention was therefore not measured. The case studies design also reduced the representation and generalisation of the results. Overall, this study has some important implications for the current research. Interventions incorporating the interests of the children with ASC appear to be an important element in order to elicit social interaction between children with ASC and their peers. The naturalistic setting, incorporating structural games with TD peers may be an effective way to create opportunities for children with ASC to increase, practise and experience interactions with their peers.

Watkins et al. (2015) reviewed 14 PMI studies which were designed to promote social interaction in mainstream settings. The authors concluded that PMI is a promising social intervention for promoting social interaction between children with ASC and their peers in mainstream settings, where 10 of the 14 studies reported positive intervention outcomes. Moreover, nine studies examined generalisation and/or maintenance and eight of them found significant generalisation effects. Eleven of the 14 studies also measured programme fidelity, although Watkins et al. (2015) noted that some studies did not measure the fidelity of the peer-implemented strategies and some only recorded the training phase and not the intervention phase of the study. Watkins et al. (2015) stated that it is important to include direct measures of fidelity across the entire intervention in order to be certain that the positive findings are attributable to the

intervention. Moreover, Watkins et al. (2015) criticised the majority of the studies as they adopted a case study design, which weakened the overall generalisation of the efficacy of PMI. Lastly, the authors attempted to identify specific characteristics of the reviewed PMIs which showed positive outcomes. However, it was challenging to make direct comparisons as there were significant differences in the intervention designs. Some PMI studies involved direct facilitator involvement in the intervention (Banda & Hart, 2010), some were child-led without adult facilitation (Mason et al., 2014); some interventions recruited trained peers (Harper, Symon & Frea, 2008) and some involved volunteered peers without addition training (Koegel et al., 2013). It is therefore difficult for educators to identify the most effective model when selecting a PMI thus leading to a potential reduction in the effectiveness of the PMI.

In addition to PMI, Integrated Play Group (IPG) also incorporates TD peers in the intervention to support social interaction for children with ASC. The IPG model aims to promote social interaction and communication, reciprocity and relationships with peers (Wolfberg, DeWitt, Young & Nguyen, 2015). This model consists of four core elements: nurturing play initiations; scaffolding play; guiding social communication; and guiding play within the "Zone of Proximal Development". The principles are grounded in Vygotsky's (1978) work, which emphasised the importance of social interaction between peers (more in-depth discussion is provided in section 2.8.2). The majority studies of IPG were multiple single-case design (e.g. Lantz et al., 2004; Richard & Goupil, 2005 cited in Wolfberg et al., 2015, p.833), and only one recent study conducted with 48

children with ASC in the US adopted a within subject design. In Wolfberg et al.'s (2015) study, they conducted a 12 weeks IPG intervention within two mainstream primary schools. Each session lasted for 60mins and each group consisted of two children with ASC and three TD peers. In addition, a trained IPG trainer (required to be psychologists, speech and language therapists, occupational therapists or special needs educators, and all needed to have completed an IPG course) and an assistant facilitated all the sessions. During the sessions, participants with ASC played together with TD participants in mutually engaging play activities supported by the facilitators. Within IPG, every session has a predictable structure which includes routines, rituals and visual supports. The activity varied in each session which incorporated the interests and developmental capacities of all participants. Within subject design was employed and used video recordings at pre- and post- intervention in the IPG session with unfamiliar peers to assess the outcomes. The Symbolic play test (Lowe & Castello, 1976 cited in Wolfberg et al., 2015, p.833) was used for coding the video recordings. Significant improvement in symbolic and social play were shown and also generalised to unfamiliar peers. Observation data was the only outcome measure which limited the representation of the results. The IPG model has important implications for the current study. First of all, the use of TD peers in a mutual interest activity was suggested to be a powerful element in effectiveness of social skills intervention. Another important factor was the importance of play. Wolfberg et al. (2015) suggested that not only play can contribute to developmental gains, "it provides for concurrent improvement in

quality of life through access to enjoyable play experiences" (p.842). Both elements are key factors in the current study, where Lego® therapy is a play based intervention and the researcher hypothesised that the inclusion of TD peers in the Lego® therapy group could potentially enhance the effectiveness of Lego® therapy.

Some schools and parents may have concerns about TD peers missing lessons to participate in the PMI (Jones, 2007). Research has shown that TD peers benefit from joining these PMIs. It has been shown that TD peers developed greater empathy, sensitivity and tolerance for individual differences through PMI (Ochs, Kremer-Sadlik, Solomon, & Sirota, 2001). Jones (2007) reviewed some studies which explored the perception of TD peers participation in PMI with children with ASC. Jones (2007) reviewed studies in which TD peers' social skills improved (Gonzalez-Lopez & Kamps, 1997); in which participants enjoyed and valued participating (Yang, Wolfberg, Wu & Hwu, 2003) and where they felt satisfied and felt that the experience was intrinsically rewarding (Whitaker, Barratt, Joy, Potter & Thomas, 1999).

Overall, both school-based social interventions and PMI have their unique contribution to make in promoting social interaction for children with ASC. The structural setting in school-based social skills interventions gives the children with ASC knowledge of social interaction skills and an environment to practise their social skills. In contrast, PMI uses its naturalistic nature to promote experience of positive interaction between children with ASC and their TD peers. However, both approaches lack consistently positive outcomes. If the existing provision

offered to children with ASC is not meeting their needs, alternative forms should be considered. An intervention which provides a balance of the two approaches, i.e. a structured setting to practise social interaction skills alongside a model of peer interaction through a motivating game or task may be more consistently effective than either approach in isolation. One such approach is Lego® therapy.

2.8. Current study – Lego® Therapy:

Lego® therapy is described as a "collaborative play therapy in which children work together to build Lego® models (LeGoff, de la Cuesta, Krauss & Baron-Cohen, 2014, p.27)." Daniel LeGoff (2004) observed two of his clients with ASC, who had never met before, interacting with each other through playing Lego® together. Lego® therapy was then developed and evaluated by him. LeGoff (2004) conducted a clinic based study with 47 children with ASC to evaluate the effectiveness of Lego® therapy, showing that Lego® therapy increases the frequency of initiating interaction and prolongs social interactions amongst children with ASC. It is also suggested that it enhances social communication and collaboration skills.

Lego® therapy is a play intervention which uses natural play equipment and has the flexibility to implement the intervention within the school setting (Andras, 2012), which can also be referred as naturalistic intervention. Kohler, Anthony, Steighner and Hoyson (2001) suggested that naturalistic interventions reinforce spontaneity in social interaction and strengthen the appropriateness of the interactions within the children's daily environments. In addition, it has been suggested that using play materials which hold intrinsic interest for children

increases motivation and promotes changes in supporting children with ASC (Attwood, 1998 ; Koegel et al., 2013) and Lego® has been shown to be rewarding for children with ASC (Owen et al., 2008), thus should help children with ASC to engage in the intervention.

Typically there are 3 roles in the Lego® therapy group for the children to take on - , the “engineer” is the child holding the instruction sheet, who instructs the “supplier” to find the correct piece of Lego® and the “engineer” will also instruct the “builder” how to build the Lego® set. The roles will be switched in every session, so that every participant can practise each role. The purpose of having three distinct roles in the intervention is to provide structured opportunities for children to practise social interaction skills, such as initiating, responding, turn taking, sharing, problem solving and paying attention to instructions. In addition, there are Lego® therapy rules, such as use indoor voices (see section 3.6.1 for the list of the rules) for the children to follow, enabling them to follow the rules and minimise adults’ involvement. The facilitator will give instructions to the participants if they require any assistance or prompts. At the end of the structured Lego® building, there is 15 minutes free style Lego play for the children to generalise their skills.

2.8.1. Reasons for using Lego® therapy

Rogers (2000) and McConnell (2002) reviewed social interventions which demonstrated empirical support for children with ASD. They identified several features which should be included in order to provide effective interventions; including peer mediation, adult facilitation, group learning, using natural settings

through the activities, arranging settings to aid interactions, involving some natural unstructured settings, and monitoring members' performance systematically. Lego® therapy in its original form fulfils most of the recommendations listed above, such as the use of group learning, natural settings and adult facilitation. The current study aims to add to the existing evidence base by including TD peers in the intervention. An evaluation of the inclusion of TD peers in Lego® therapy in educational setting has not been examined before, a factor which may potentially enhance the overall effectiveness of the intervention

According to Blatchford, Galton, Kutnick, and Baines (2005), there are 4 key principles to create effective group work: (1) Emphasis on the relationships between each participant within the group, such as trust, sensitivity and respect. In addition, participants' communication and collaborative skills will impact on the ways in which they relate to each other. (2) Grouping arrangement, for example layout, number of people, structure and stability. (3) Tasks that allow participants to work together and communicate. (4) Adult involvement so that the group can work independently, which includes monitoring and scaffolding. One can argue that the social deficits of the participants with ASC may serve as a barrier for them when learning how to play collaboratively, because the relationships and communication between participants are likely to be insufficient. However, if the other 3 elements (2, 3 and 4) in Blatchford et al.'s (2005) principles can be maintained at high quality, it may be possible to create effective collaborative

play as well as target and improve participants' social interaction skills during the intervention.

2.8.2. Theories underpinning Lego® therapy and implications for current study:

It is important to understand how and why Lego® therapy may help promote social interaction. Playing Lego® collaboratively is the core component of Lego® therapy, which can be separated into two subcomponents: collaborative play and the use of Lego® as the medium. Theories listed below illustrate how these subcomponents may support the social interaction skills for children with ASC.

Vygostsky's theory on collaborative Play:

Collaborative play is where children join together to complete a joint game/activity. This process requires high frequency of social interaction between children and also demands the practice of other skills, such as social and language skills. Vygostsky's social interactionist perspective (1978) suggested that cognitive processes are triggered by social contexts, which are a crucial component of development (Bodrova & Leong, 2007). According to Vygotsky (1978), development consists of two levels. The first level refers to independent problem solving, where the learner has reached the level where they are capable of solving problems without support. The second level is referred to as "zone of proximal development (ZPD)". ZPD is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p.86).

This theory suggests that development is through social processes which involves assistance by others, adults or peers, who are more competent (Bodrova & Leong, 2007). In Lego® therapy, social interaction is not only the exchange of information between peers, it also plays an important part in enhancing play and social development. These social exchanges provide opportunities for children to learn social interaction skills, such as ways to initiate, respond, and contribute to on-going interactions. Moreover, the involvement of TD peers in the current study, where it was hypothesised that they were the more "capable peers", meant that they could work in the assistant role within the intervention in order to help the other members with ASC to develop their social interaction skills.

Social interdependence theory is an extension of Deutsch's (1949; cited in Johnson & Johnson, 1999) work applying to cooperation and competition within groups. Johnson and Johnson (1999, p186) theorise as to how social interdependence is created, which, they suggest, determines the way individuals interact and which, in turn, affects outcomes. Positive interdependence will be created when members in the group believe that they can reach their goals if, and only if, the other members with whom they are cooperatively linked also reach their goals. As a result, members would promote each other's efforts to achieve the goals (Johnson & Johnson, 1999). Positive interdependence is hypothesised to be established through Lego® therapy activities, meaning that each participant has to execute their role in order to build the Lego® model

together. Positive interdependence will lead to enhanced efforts to achieve and positive interpersonal relationships (Johnson & Johnson, 1999).

The use of Lego®:

The REPIM illustrates that children who experience negative peer interactions may withdraw from social situations (Humphrey & Symes, 2011). Therefore, some social interventions specify external reinforcement to motivate participants to take part in the training (Apple et al., 2005; Owen-DeSchryver, Carr, Cale & Blakeley-Smith, 2008). However, this approach has been criticised because external reinforcement is unnatural in every day situation as typical social interaction does not depend upon external reinforcement. In addition, the main criticism is that it is difficult to generalise the social skills learned by using external reinforcement (DiSalvo & Oswald, 2002).

In contrast Lego® therapy has been recognised as highly motivating for children with ASC (Owen et al., 2008). Owen et al. (2008) showed that participants rated this intervention as highly rewarding and were motivated to participate. Owen et al. (2008) suggested that empathising-systemising theory (E-S; Baron-Cohen, 2009) is able to account for participants' high levels of motivation and engagement. The collaborative play nature of the intervention may potentially be able to help explain how children with ASC can develop their social interaction skills within the intervention.

E-S theory, developed by Baron-Cohen (2009), attempts to explain the non-social areas of strength of children with ASC, such as good attention to detail,

narrow interest and islets of ability. This theory may also account for some elements of social deficits, such as delays and deficits in empathy, whilst explaining the areas of strength by reference to intact or even superior skill in systemising (Baron-Cohen, 2009)

"Empathising" is defined as the incentive to recognise other people's emotions and thoughts, and to react with an appropriate emotion. Empathising helps a person to predict other people's behaviour and also to care about their feelings (Baron-Cohen, 2009). On the other hand, "Systemising" is the incentive to analyse the variables in a system. A system is defined as a concept that follows rules, for example train timetables are referred to as numerical systems, distinguishing between types of stone or wood is referred to as a collectable system (Baron-Cohen, 2009). Individual's attempts to identify the rules that run the system and predict how the system behaves are referred to systemising (Baron-Cohen, 2009). Children with ASC have a strong drive to systemise and they are attracted to systems and objects that are predictable. Baron-Cohen (2009) describes how children with ASC typically have above average systemising ability and below average empathising ability.

Lego® is a toy that can be used systemically. Therefore, children with ASC are attracted to this game because of the nature of the activity (Owen et al. 2008). Furthermore, Koegel et al. (2013) proposed that social intervention incorporating the interests of children with ASC promote more social interaction. Given that participants with ASC are naturally attracted to this activity, it could be argued

that they feel more comfortable and motivated to learn and practise social interaction skills.

2.8.3. Review of current evidence of Lego® therapy:

The two initial studies were conducted by the creator of Lego® therapy in the USA (LeGoff, 2004; LeGoff & Sherman, 2006). They conducted the evaluation in a clinical setting. In LeGoff's (2004) study, there were 47 participants with ASD aged from 6 – 16 year-old. Participants were assessed with pre-treatment and post-treatment measures on observation data: self-initiated social contact (SISC), duration of social interaction (DSI) and standardised questionnaire: the Gilliam Autism Rating Scale-Social Interaction (GARS-SI) subscale. Participants were divided into two groups, group A with 12 weeks wait and 12 weeks of treatment, and group B with 24 weeks wait and 24 weeks of treatment. Both groups showed improvements in all the measures. Observation took place during unstructured periods in school contexts. Group A and B showed 74% and 175% increase in DSI respectively. However, some participants were rejected due to behavioural problems or lack of responsiveness. In addition, there was no blinding of the observational data collection, which could potentially lead to subject bias. Furthermore, Lego® therapy in both studies was implemented by the creator, and descriptions of the intervention and intervention fidelity were not included, potentially creating a threat of facilitator bias due to the creator's input into the project.

Owen et al. (2008) compared the effectiveness of Lego® therapy and the Social Use of Language Program (SULP) by using randomised block design in a clinic

setting in the UK. They recruited 28 participants from 6 – 10 year-old children with ASC. They used GAR-SI; Vineland Adaptive Behaviour Scale socialisation and communication domains (VABS; Sparrow, Balla & Cicchetti, 2005 cited in Owen et al., 2008, p.1950); and the observed SISC and DSI in school playground as their outcome measures. In addition, they also recorded parent satisfaction and child motivation at the end of treatment period. The use of SULP begins with narratives about monsters that struggle with social situations, demonstrated by the therapist. Then children practise different targeted social skills and play games in different situations within the group setting. As in LeGoff (2004), and LeGoff and Sherman's (2006) studies, Owen et al.'s (2008) study did not include any TD peers for potential skills generalisation.

After 1 hour per week over 18 weeks of treatment, Owen et al. (2008) found that children who took part in Lego® therapy showed positive changes on the VABS maladaptive behaviours scale and DIS. Children in the SULP showed improvements on VABS socialisation and communication scales. More children rated Lego® therapy higher in terms of motivation. Inter-rater reliability for their observational data was high, 0.97 and the observers were blind in the study.

Despite the strengths and positive outcomes of this study, there were some limitations. Observation data was collected by the author and for only 10 minutes each time and the intervention was also implemented by the author, which may potentially have caused subjective bias. Overall, even given the limitation noted above, LeGoff (2004) and Owen et al. (2008) illustrated that Lego® therapy is effective in promoting social interaction for children with ASC.

All the evaluation studies of Lego® therapy were conducted in clinic with two exceptions. Andras (2012) conducted a ten-week Lego® therapy intervention within the school context in the UK. In Andras' (2012) study, she explored the effectiveness of Lego® therapy on social interaction for eight primary school pupils by using a within groups design. Lego® therapy was run by school staff and the author observed the target children in the playground recording four types of interaction, verbal, proximity, touch and copying. Her results showed that the mean of social interaction increased after the intervention, such as an increase in verbal communication and engagement in organised games. Although the author described the procedure of the intervention, programme fidelity was again not included. Moreover, inter-rater reliability was not included for the observational data, so the reliability of the observations was questionable.

Brett (2013) conducted an evaluation study on Lego® therapy in a school context in the UK. The study recruited 14 students with ASC from nine primary schools to participate an eight-week school-based Lego® therapy intervention. Within-subjects quasi-experimental design was employed. The author collected VABS socialisation and communication domains from class teachers, and observed SISC and DSI for 20minutes during each intervention phase in the playground as the outcome measures. The study had TAs to conduct the intervention in schools and a programme fidelity check was included to maintain the quality of the implementation process of the intervention. Significant improvements were found in adaptive socialisation and play at post intervention. Moreover, qualitative data was also collected from 13 participants with ASC in the second part of the study

(2013). Results showed that children with ASC enjoyed playing Lego® collaboratively and spoke positively about building it together. However, they preferred to build Lego® alone during the 'free style' period. In addition, children with ASC expressed that social difficulties within groups, specific roles and factors relating to Lego® sets reduced their enjoyment. Brett's (2013) study had a number of unique elements in the design; first of all, the study was conducted in nine schools and Lego® therapy was run by the school TAs which had high ecological validity (Cohen, Manion & Morrison 2007). Secondly, the inclusion of programme fidelity and a training manual was an effective way of controlling the implementation process across nine schools. Thirdly, children's views were collected in order to provide more in-depth information about their perceptions of the intervention. One of the limitations in Brett's study was the absence of control group. Although a base-line measure was taken, a comparison group could have strengthened the results. This study has some important implications for the current study. The use of programme fidelity and a training manual were helped ensure consistent implementation of the programme within school settings. In addition, this was one of the first studies to collect qualitative data, which drove the current researcher to further expand the evidence base by collecting TAs' views. Since implementing a clinic based intervention in educational contexts can be significantly different, it is important to understand the process and practicality of the implementation.

Huskens, Palmen, Van der Werff, Lourens and Barakova's (2014) study had a number of unique elements in their design. First of all, they employed a robot to

run the Lego® therapy session instead of trained adult. Secondly, instead of having three children with ASC, they had 2 children in the Lego® therapy group, one with ASC and his/her TD sibling. Multiple baseline case studies were used to investigate this robot-mediated Lego® therapy intervention (N=3). In total five 30-mins Lego® therapy sessions were conducted in a clinic setting. Husken et al. video recorded three 30-min baseline sessions and five 30-min post-intervention sessions. During the baseline and post-intervention sessions, each group was given assignment card without the Robot-mediation. The aim of the study was to investigate Lego® therapy's potential to improve collaborative behaviours (i.e., initiations, responses and playing together) between children with ASC and their siblings in therapeutic settings. Although they did not find any significant results, this study has several important implications for this current project. Husken et al (2014) conducted five 30-min training sessions, which were less intense than previous studies by LeGoff (2004), LeGoff and Sherman (2006), and Owens et al. (2008). This reduced participants' opportunities to practise different roles and to communicate with other participants. Participants' parents reported that there was a positive impact on the collaborative behaviours of their children outside therapy session. This may potentially suggest that the inclusion of TD participants may lead to enhanced generalisation.

In sum, there are a number of implications in the literature relating to Lego® therapy for the current study. Firstly, previous work was largely clinical in nature with only two studies investigating Lego® therapy in an educational context, thus more evidence is required to examine the use of Lego® therapy in school settings.

Secondly, only one previous study used TD peers in a clinic setting for evaluating the intervention, whereas the use of TD peers in school settings may potentially lead to generalisation of acquired skills and further investigation should therefore be conducted. In addition, the feasibility of implementing Lego® therapy within educational setting has not been explored. Lego® therapy is a relatively new intervention and gathering information about the implementation process within the school environment would help to maintain the efficacy and the sustainability of the intervention (Koegel, Kuriakose, Singh and Koegel, 2012). Intervention fidelity supports was only included in two of the previous studies (Huskens et al., 2014; Brett, 2013), as highlighted in section 2.4.2. intervention fidelity data provides information about the quality and consistency of the implementation process and therefore it should be included when evaluating a social skills intervention (Appendix 1 shows the current literature of Lego® therapy used with children with ASC).

2.9. Rationale and structure of the current research project:

The importance of social interaction for all children has been clearly highlighted in the literature reviewed above. It shows that children with ASC struggle to interact with others because of their social impairments. Children with ASC are increasingly likely to attend mainstream schools and it is hoped that exposure to TD peers within a social environment will enhance the social interaction and communication skills of children in this population (Reed & Osborne, 2014; Waltz, 2013). However, literature showed that children with ASC have difficulties improving their social interaction without appropriate support (DiSalvo & Oswald,

2002). The REPIM predicts how children with ASC may fall into a vicious cycle of negative social interaction experiences and intervention needs to be planned to interrupt such negative cycle (Humphrey & Symes, 2011). Although there are a range of school-based social skills interventions available children with ASC, this literature review cites evidence which suggests current provision may not be fully effective (Bellini et al., 2007).

There are suggestions that Lego® therapy may be effective for children with ASC to enable them to learn social interaction skills (Brett, 2013; LeGoff, 2004; Owen et al., 2008). This intervention involves playing Lego® collaboratively where collaborative play has been shown to promote a high frequency of social interaction and support social development. Lego® has been recognised as a toy which children with ASC tend to be attracted to. In addition, this intervention is beginning to be used across schools in the LA where the researcher is practising as a TEP. However, there is currently only a limited evidence base and this needs to be improved by further research to show its effectiveness and suitability for the population it aims to support. Furthermore, qualitative data has not been collected from the implementer of Lego® therapy in any published research as yet. In this study, as TAs are running the intervention, a range of information can be gathered including TA perceptions of the children's performance in the group, practicality of running Lego® therapy in school, and the process of implementation in educational context. Moreover, the literature reviewed above highlighted the importance of including TD children in social skills interventions (Koegel et al., 2013; McConnell, 2002; Rogers, 2000; Wolfberg et al., 2015) and

only one previous Lego® therapy study included TD sibling in clinic setting. Therefore, the current study aims to explore the effectiveness and process of the Lego® therapy intervention in school settings and the participation of TD peers in promoting social interaction for children with an ASC.

2.10. Research Questions:

The main aims of the current study are: 1) To evaluate the effectiveness of an 8-week Lego® therapy group intervention for children with ASC to improve their social interaction and features of social impairment. 2) To evaluate the impact of including a TD child in the Lego® therapy group on the social interaction and features of social impairment of children with ASC 3) To explore TAs' views of delivering Lego® therapy and their perceptions of the effectiveness of the intervention.

Five research questions were developed related to the aims:

Aim 1: To evaluate the effectiveness of an 8-week Lego® therapy group intervention for children with ASC to improve their social interaction and features of social impairment.

RQ1.1 Do the levels and frequency of social interaction of participants with ASC in the playground improve as a result of attending the Lego® therapy?

RQ1.2 Do social impairment features of participants with ASC, when rated by their class teacher, improve after attending the Lego® therapy?

Aim 2: To evaluate the impact of including a TD child in the Lego® therapy group on the social interaction, social engagement and other social behaviours of children with ASC

RQ2.1 Does participation of a TD child in the Lego® therapy group impact upon the social interaction in the playground of children with ASC?

RQ2.2 Does participation of a TD child in the Lego® therapy group impact upon the social impairment features of children with ASC when rated by their class teacher?

Aim 3: To explore TAs' views of delivering Lego® therapy and their perceptions of the effectiveness

RQ 3: What are the views of TAs delivering Lego® therapy groups about the implementation and effectiveness of Lego® therapy?

3. Chapter 3 – Methodology

3.1. Chapter Overview:

This chapter will inform the reader of the methodology which was employed in order to answer the research questions. The section will begin with an introduction to the philosophical approach adopted in the current research. The specific research methods will be illustrated with comparison to alternative approaches followed by description of participant selection and characteristics. The chapter will then provide details of the measures which were used to collect data in order to answer the research questions. Lastly, it will outline the procedure of implementing Lego® therapy in school, highlight the importance of intervention fidelity and illustrate the ethical considerations of the current study.

3.2. Aims of the research:

This research attempted to measure intervention effectiveness in terms of improving social interaction and reducing social impairment features of children with ASC. This study attempted to build on the work of Andras (2012), Brett (2013), LeGoff (2004) and Owen et al. (2008) and examine how Lego® therapy may potentially influence participants' social interaction in educational settings and impact on social impairment features. The current study took place in a 'real-world' setting (schools) where a randomised controlled trial was difficult to obtain. Additionally, as randomised controlled trial may not have supported the collection of rich educational context-related information. This research therefore adopted a mixed-methods approach which tried to gain understanding of the relationship

between variables by using a quasi-experimental design and also obtaining qualitative information in order to understand the potential factors that could influence both the implementation process and the effectiveness of the intervention. In addition, this study was the first study to include a TD peer in the Lego® therapy group in the school setting to investigate whether it would have a positive effect on the effectiveness of Lego® therapy.

3.3. Philosophical approach adopted in the current research

In the current research, the researcher was working within the pragmatic paradigm for the evaluation of Lego® therapy. Lane and Corrie (2006) described EPs as 'scientist-practitioners', in other words integrating the post-positivist's objectivism and the constructivist's creative subjectivity [1] (Robson, 2002). Bhaskar (1998) claimed that psychologists are able to provide 'explanatory critique' of a situation based on scientific exploration, while considering the context and participants' perceptions. It gives power to the researcher to seek 'the wider picture' disclosing what works for some people in some contexts (Matthews & Ross, 2010) and attempts to explain why a particular event occurred in that way and at that time (Robson, 2002).

The researcher was curious not just whether Lego® therapy intervention was effective in improving social interaction for children with ASC, but also with 'why'

[1] Post-positivism refers to the assertion that a single reality exists but recognises that there is acceptance that the researcher's values, knowledge and hypotheses can affect the research. Thus the reality may only be identified imperfectly due to the researcher's limitations (Creswell & Plano Clark, 2011). The constructivist paradigm asserts that there are multiple realities and the constructivist believes this paradigm attempts to illuminate and understand the reality of others through the narrative and the subjective views of the participants' experiences (Creswell & Plano Clark, 2011).

and ‘how’ the intervention was or was not effective. Pragmatism connects the gap between quantitative and qualitative approaches, meaning that research within this paradigm integrates both post-positivism and the constructivist paradigm (Creswell & Plano Clark, 2011). Therefore, the pragmatic paradigm guided the researcher to choose methods from a variety of possible approaches provided these methods had the potential to answer the research questions. The researcher used a mixed method approach to collect quantitative and qualitative data to allow for the exploration of Lego® therapy’s effectiveness and implementation.

3.4. Research design:

The current research was a small scale exploratory study investigating the effectiveness and the application of Lego® therapy. The aims were to understand whether Lego® therapy could improve the social interaction of children with ASC during natural setting in the school day, i.e. in the playground during lunch time, and improve the degree of social impairment for children with ASC. A further aim was to investigate whether different grouping combinations could enhance the effectiveness of Lego® therapy, i.e. comparison between Lego® therapy consisting of only ASC children and Lego® therapy consisting of two ASC children and a TD child would have a positive impact on children’s social interactions. The final aim was to investigate the feasibility of running Lego® therapy in school and explore the practicality of the implementation process. It was hoped that the outcomes would lead to a combination of summative and formative data which may help provide valuable findings to professionals (Cline,

2012). In order to address these questions, the researcher gave careful thought to the most appropriate experimental design.

3.4.1. Quasi-experimental research design:

'Quasi-experimental design' is defined as "…a research design involving an experimental approach but where random assignment to treatment and comparison groups has not been applied" (Robson, 2002, p133). It is recognised as an appropriate design when studying the impact of an intervention on a group of children with ASC (Coolican, 2006). The type of quasi-experimental design in this project was a pre-test, post-test non-equivalent groups design (Robson, 2002). Instead of randomly assigning participants, this began with setting up the experimental and control groups. For the purposes of this study, there were 2 experimental groups and a control group. Once the groupings were established, pre-intervention measures were collected. Both experimental groups received Lego® therapy, while the control group received no treatment. Finally, post-intervention measures were conducted concurrently with each group.

Quantitative data were collected from three groups of participants;

1. Pure Group: Consists of three children with ASC
2. Mixed Group: Consists of two children with ASC and a TD child
3. Control Group: Children with ASC who did not receive any social intervention

The qualitative data was collected through semi-structured interview and embedded in this quasi-experimental design after Lego® therapy implementation

for the purpose of understanding the TAs' experiences of running the Lego® therapy group. Thus, this study design was referred as an embedded quasi-experimental design, where qualitative data is embedded within a quasi-experimental design (Creswell & Plano Clark, 2011).

As random allocation was not possible in this study, quasi-experimental design was selected as it was the next best-fit model for the school context. Further, there were a number of features making quasi-experiment design more desirable in this study. 1.) According to Robson (2002), quasi-experimental designs highlight the significance of contextual factors upon the effectiveness of an intervention, leading to the question of 'what works, for whom, and in what situations?'. This fits well with the ethos of EPs as scientific-practitioners, who emphasise rich contextual description and investigate evidence based interventions in educational settings. 2.) Lego® therapy has been critiqued for the lack of evidence in the real world context (LeGoff & Sherman, 2006). Quasi-experiment in a natural setting may therefore provide more information as to the effectiveness of Lego® therapy.

3.4.2. Case Study design:

ASC is described as a heterogeneous group across all ages (Happé, Ronald & Plomin, 2006) in which individuals can vary in terms of their social and behavioral patterns and severity. In addition, the heterogeneity may cause problems in this study as individuals' differences were likely to be magnified in this small sample size, which in turn, may have affected the overall results. The researcher understood this weakness could affect the overall power of the quasi

experimental design; therefore, case study was also incorporated in addition to the quasi experiments. In explanation of case study, it can be referred to as an explanatory analysis of a person or group; its purpose is to uncover rich and detailed analysis of behaviour. Robson (2002) states that it is possible to study a single case or multiple cases by using qualitative and quantitative evidence.

Maximum variation sampling approach (MVSA; Patton, 2003) was applied to select participants for the case study. The principle of MVSA is that extreme cases are selected deliberately (Teddlie & Yu, 2007). The purpose of implementing MVSA is to look for variations within the intervention as well as possible explanations (i.e. common patterns) for them. The logic behind MVSA is that "any common patterns that emerge from great variation are of particular interest and value in capturing the core experiences and central, shared aspects or impacts of a program" (Patton, 2003, p.235). MVSA is one of the purposeful sampling techniques. Four cases in this study were purposively chosen "based on specific purposes associated with answering research questions" (Teddlie & Yu, 2007, p.77) and the application of MVSA is used for comparisons or contrasts (Teddlie & Yu, 2007).

In the current study, a case studies design was used to weave quantitative and qualitative data together. Quantitative measures were collected before and after intervention, and the changes in the primary outcome measure were used as criterion in the case selection process. Qualitative data was collected through semi-structured interviews with TAs after intervention. Detailed descriptions

about the performance of ASC participants were collected and drawn together with the quantitative measures to give clearer picture of the selected cases.

There were three selection criteria: 1. Equal number of cases from the pure group and the mixed group; 2. An increase of more than 1 standard deviation in the primary outcome measure result or a lack of improvement following the intervention; 3. Participant's names that had been mentioned on at least five occasions by TAs. Reynolds (2000) stated that one standard deviation change can be used as an initial investigation on program impact. Although this criterion could not confirm whether the participant did or did not benefit from Lego® therapy, the purpose of using this criterion was to select a number of participants who appeared to have a larger scale of change than other participants in the study after attending Lego® therapy. Since the primary outcome measure, the Playground Observation of Peer Engagement (POPE; Kasari, Rotheram-Fuller, & Locke, 2010), is not a standardised assessment tool, one standard deviation change was therefore used as a criterion.

The pre-intervention outcomes' standard deviations were used to compare the changes. The secondary outcome measure results, the Social Responsiveness Scale 2nd Edition (SRS-2; Constantino & Gruber, 2013), were used to provide supportive evidence in an attempt to explain changes.

3.5. Research Phases:

Lego® therapy in this study was an eight weeks intervention which was implemented by TAs. Quantitative data were collected in phase 1 and phase 2

and qualitative data were collected in phase 2. Table 1 lists the different phases of the current research project.

Table 1 Research phases and data collection

	Phase 1: Pre-intervention	**Intervention Phase**	**Phase 2: Post-intervention assessment**
Duration	Week1-2	Week 3-11(including half-term)	Week 12-13
Pure Group	Lego® therapy training for TAs in pure and mixed group. Cognitive profile assessment for all the participants with ASC **Pre-intervention measure:** 1. The POPE x 2 during lunch time 2. Teacher rated the SRS-2	8 weeks Lego® therapy The researcher supported the 1st and 5th session.	**Post-intervention measures:** 1. POPE x 2 during lunch time 2. Teacher rated the SRS-2 3. Semi-structured interview with the TAs who ran the intervention
Mixed Group			
Control Group		No Intervention	

3.6. Lego® therapy:

Lego® therapy was developed by LeGoff (2004) for individuals with ASC from ages 5-17 years. The aim of the intervention is to promote participants' social interaction and communication skills through building Lego® collaboratively. The

overall structure and features are reported below and the training programme for the TA is attached in appendix 2.

3.6.1. Overall structure and features

The Lego® therapy sessions were conducted by the school TAs in this study. Three children in key stage 2 and the TA met together once per week for eight weeks in school, for sessions of 45 minutes duration each. The TA's role was to prompt interaction among the children and help them come up with their own solutions. Lego® therapy sessions consisted of two sections (LeGoff et al., 2014); 30 minutes of collaborative Lego® project and 15 minutes freestyle building.

1. Building sets with instructions: Children were assigned to one of three roles: engineer, builder or supplier.
    a. Engineer: Reads the instructions and describes how to build the set.
    b. Supplier: Picks out the correct pieces when the engineer gives instructions.
    c. Builder: Follows the engineer's instructions and puts the pieces together
2. During the freestyle building children were asked to build models of their own design collaboratively.

Lego® rules were shown and referred to them throughout sessions. The Lego® rules were:

1. Build things together.
2. If it gets broken, fix it or ask for help.

3. If someone else is using a piece, ask first (don't take it).

4. Use indoor voices.

5. Use polite words.

6. Sit nicely (keep your hands and feet to yourself)

7. Tidy up and put things back where they came from

8. Do not put Lego® bricks in your mouth.

3.6.2. Lego® therapy training:

The researcher received a training session on Lego® therapy from a qualified SLT in the LA in June 2015. He also shadowed the therapy session once and ran the Lego® therapy twice with the SLT's support. The researcher created a training program based on the training material from the SLT, LeGoff et al's (2014) training manual and Brett's (2013) training manual (See Appendix 2). The researcher provided a 1.5 hours training for TAs in September 2015. In addition, the researcher ran the first Lego® therapy session with each TAs in order to support and demonstrate the implementation.

3.7. Participants and sampling:

The current project aimed to develop an understanding of how Lego® therapy might support the social interaction of children with ASC within mainstream schools. It was also interested in exploring whether the inclusion of a TD child within the group could influence the effectiveness of the intervention. The nature of the study required participating schools to have 2 or more children with ASC

so that they could participate in the Lego® therapy within the same school and to be able to identify a TD child who had parental consent to participate. In addition, this project also required the participating schools to have a TA available to run the Lego® therapy group on a weekly basis.

3.7.1. Recruitment procedure:

Recruitment of participants took place within an inner London LA, where the researcher was on placement as part of his doctorate as TEP. Lego® therapy has been used by the Speech and Language service in the LA as part of their practice and they have a database of schools which have or have not used this intervention. Invitation letters were distributed to primary schools which had not previously used Lego® therapy. These letters consisted of a description of the proposed project and, a consent form for the school and parents (Appendix 3). Forty four of sixty four primary schools had not used Lego® therapy and letters were sent to these schools. Eight schools showed initial interest in participating in the study. The researcher contacted the school SENCo through emails and phone calls followed by a meeting with the school SENCo in order to provide further details about the study. The participants were selected in consultation with school staff and SENCos and in accordance with the selection criteria. Of the eight schools only five schools had matched numbers of participants who reached the sampling criteria, which will be explained in the next section.

3.7.2. Child participants

This study recruited two types of child participants- children with ASC and TD children, i.e. children with no identified SEN. The following shows the sampling criteria:

Sampling criteria for participants with ASC:

1. Diagnosis of high-functioning autism, Asperger's syndrome, Atypical autism, or Pervasive Developmental Disorder – not Otherwise Specified (PDD-NOS).
2. Pupils who attend mainstream primary school
3. Full Scale IQ above 70
4. The ability to sustain focus on a table task for 20 minutes
5. Pupils who are currently not receiving any intervention targeting social interaction skills
6. Key stage 2

Sampling criteria for TD participant

1. Pupils who attend mainstream primary school
2. No identified SEN
3. Key stage 2

The allocation of the group was matched by their year group, number of students with ASC, the availability of TD children, the availability of TA and discussion with SENCos. The final sample consisted of 19 children with ASC from 5 schools; 6 participants with ASC in the pure groups, 8 participants with ASC and 4 TD

participants in the mixed groups and 5 participants in the control group (See Table 2 for demographic data for the participants with ASC).

Table 2 Demographic data of participants with ASC who consented and participated the study

		Pure group	Mixed group	Control group
Gender	Male	6	7	5
	Female	0	1	0
School	School A	3	2	0
	School B	3	2	0
	School C	0	2	2
	School D	0	2	0
	School E	0	0	3
Year group	Yr 3	0	1	0
	Yr 4	3	1	0
	Yr 5	3	4	2
	Yr 6	0	2	3
Ethnicity	Bangladeshi	1	0	0
	Black British Caribbean	1	5	1
	Chinese	0	1	0
	White British	0	1	2
	Other white background	4	1	2
Diagnosis	Asperger's syndrome	3	4	3
	Autism-high functioning	2	2	2
	Autism	0	1	0
	PDD-NOS	1	1	0

3.7.3. Adult participants:

One of the requirements for participating schools was to arrange a TA to run Lego® therapy on a weekly basis for 8 weeks. Six TAs who had experience of working with children with ASC from 2 to 8 years were recruited for the study. Lego® therapy training was provided by the researcher once they were confirmed by the school SENCo. TAs were invited for a post-intervention interview for the study to explore their perception of running the intervention.

3.8. Study variables:

Lego® therapy was the independent variable of this study. The dependent variables (DV) are listed below and illustration as how they were measured is provided.

DV1 was the level and frequency of social interaction of the participants with ASC during lunch time in the playground. The POPE (Kasari et al, 2010) was used to measure DV1 in order to answer RQ 1.1 and 2.1.

DV2 was the social impairment features of the participants with ASC. This was collected from their class teacher by using the SRS-2 (Constantino & Gruber, 2013) in order to answer RQ 1.2 and 2.2. This aimed to gather understanding of the social features of the participants with ASC within the school setting and detect any generalisation after Lego® therapy.

DV3 was the implementation process and participants' performance within the session. This was collected through semi-structured interviews with the TAs at post-intervention.

3.9. Measures:

ASC is described as a continuum and children with ASC may vary significantly from one another (Happé et al., 2006). Therefore, the researcher felt that it was important to collect participants' cognitive ability in order to provide more detail than their demographics profile alone. The DVs were measured by several outcome measures in this study. Outcomes measures were further categorised into primary outcome measures, secondary quantitative measures and qualitative measures.

3.9.1. Cognitive profile of the participants with ASC:

The cognitive profiles of the participants with ASC were collected once at phase 1 before Lego® therapy started. The purpose of collecting their cognitive profile was to gain an understanding of participants' verbal and non-verbal ability in order to make inferences about the data in terms of its generalisability to other children with ASC.

Wechsler Abbreviated Scale of Intelligence 2nd edition (WASI-II; Wechsler, 2011)

The WASI-II is a short measure of verbal, nonverbal and general cognitive ability measure. It contains four sub-tests: 1) Block design subtest measures the ability to analyse and synthesise abstract visual stimuli; 2) Vocabulary subtest measures word knowledge and verbal concept formation; 3) Matrix reasoning subtest measures fluid intelligence, broad visual intelligence, classification and spatial ability; 4) Similarities measures verbal concept formation and reasoning.

The WASI-II has high reliability coefficients, averaging reliability ranging from .87 to .97 on all scales for all ages ranges. It correlated strongly with the WISC-IV, a more comprehensive Wechsler Intelligence Scale for children – Fourth Edition, which indicates that the WASI-II provides a reliable cognitive profile of the children who took part in Lego® therapy.

As part of the selection criteria for participants with ASC, IQ above 70 was required because verbal reasoning and spatial ability were important in enabling participants to access the content in Lego® therapy. Therefore, the WASI-II was conducted with participants with ASC to ensure they had sufficient ability to participate in the Lego® therapy.

3.9.2. Quantitative measures:

Quantitative data was collected during phase 1 and phase 2 of the research study. Phase 1 quantitative pre-intervention data was collected at the end of September 2015. This included a systematic observation schedule, the POPE (Kasari et al., 2010), and the use of a teacher report questionnaire, the SRS-2. The same quantitative measures were used in phase 2 in December 2015. The following is a summary of the quantitative data measures.

Primary outcome measure - Systematic Observations in playground

Social interaction involves a significant number of non-verbal behaviours that needed to be measured for the present study. “Observation studies are superior to experiments and survey when data are being collected on non-verbal behaviour” (Cohen et al., 2007, p. 206). The use of observation provided the

researcher with ‘live’ data within a naturally occurring situation, which has a high ecological validity (Cohen et al., 2007). Robson (2002) also supports this idea and claims that “actions and behavior of people are central aspects in virtually any enquiry” (p.309). Therefore observation was deemed to be a suitable measurement to observe how participants may change their interaction before and after the intervention.

Robson (2011) listed two domains in observational methods: the level of pre-structure and the role adopted by the observer. In this study, the researcher adopted the stance of passive, non-intrusive observer, i.e. keep a good distance from the target child and without interacting with him or her. This allowed the researcher to collect specific data on the incidence and frequency of the children’s social interaction in the playground.

The POPE (Kasariet al., 2010), is a systematic observation schedule that was adapted from Sigman and Ruskin’s (1999) levels of peer interaction schedule. This observation schedule has been used in several studies for detecting levels and frequency of interaction for children with ASC (e.g. Frankel, Gorospe, Chang & Sugar, 2011; Locke, Kasari & Wood, 2014). See appendix 4 for the POPE observation schedule. The POPE is a timed-interval behaviour coding system that records children’s levels and frequency of social interaction behaviours with peers in the playground context. The observer observed the target child from a distance in the playground for 40 seconds and then coded for 20 seconds over a 15 minutes period during lunch time. Variables coded include: solitary play, proximity, onlooker, parallel play, parallel aware, joint engagement and games

with rules. These 7 codes were separated into 3 levels of social interaction for statistical analysis, non-social behaviour, low-social behaviour and high-social behaviour (Kasariet al., 2010; Sigman & Ruskin, 1999; see table 3 for further description). In addition, the observer identifies 2 types of discrete interactive behaviour: target child initiates and target child responds to social initiation.

Hauck, Fein, Waterhouse and Feinstein's (1995) Behaviour Coding Scheme was also considered. It is an observation schedule which collects positive and negative initiations, attention seeking initiation and avoidance during 15 seconds intervals over a total observation time of 15mins. Hauck et al. (1995) suggested that this observation is more suited to coding of behaviour in the classroom. In addition, some of the observation codes, such as echolalia behaviour, may require near observation. Since the aim of the current research was to measure the target children's social interaction behaviour in the playground and in order to minimise the disturbance of the target children, non-intrusive style of observation was preferred. Therefore, the POPE was chosen over the Behaviour Coding Scheme.

In order to improve the reliability of the observation data compared to that gathered by Owen et al. (2008), the duration and frequency were increased in the current study. All the participants were observed for an equal number of times: fifteen minutes per observation and twice at each phase for a total of four observations over the course of the project. In addition, the researcher trained a second observer, who was also a TEP, in the use of the observation schedule for

purpose of inter-rater reliability. 20% of phase 1 observations were coded by two observers to ensure reliability and reduce researcher bias.

Table 3 The Playground Observation of Peer Engagement code and description (POPE; Kasari, et al., 2010)

Category	Code	Description
Levels of interaction		
Non Social	Solitary play	Target child plays alone and there is not any peer within 3 feet. Target child does not have mutual eye gaze with any peer.
	Proximity	Target child plays alone within 3-foot range of peer and is not engaged in a similar activity.
Low Social	Onlooker	Target child shows one-way awareness of child who is 3 feet away. Target child appears to be watching a specific peer or a group of peers or a game with interest or the intent to participate.
	Parallel Play	Target child and peer occupied in similar activity but there is no social behaviour.
	Parallel Aware	Target child and peer occupied in similar activity and mutually aware of each other.
High Social	Joint Engagement	Target child and peer occupied in direct social behaviour, activities with a turn taking structure.
	Games with Rules	Target child participates in organised games/sports with rules such as tennis, basketball, 4-square
Discrete Behaviours	**Description**	
Initiates	Interaction is initiated by the target child, e.g. greets, asks to play games, offers objects, states facts, etc.	
Response to Social interaction	Target child responds to an approach of peer with a nonverbal gesture, or verbal language.	

Note: If the child is engaged in a conversation, record in the appropriate column whether the target child initiates and responds at the start of the conversation. No extra mark is recorded unless there is a break in the conversation.

Secondary outcome measure: The Social Responsiveness Scale 2nd edition (Constantino & Gruber, 2013):

The SRS-2 is a questionnaire which contains 65 questions. The SRS-2 identifies social impairment features in ASC and quantifies its severity. It can be completed by a teacher or parent for children or adolescents between 4 and 18 years old. The researcher intended to collect SRS-2 data from the class teacher and parents of all the participants with ASC. However, parental response rate was very low. After several reminders, a majority of parents' questionnaire had not been returned 2 weeks after the start of intervention. Therefore, the SRS-2 data was collected and analysed from all the target participants' class teachers only during phase 1 and 2.

The teacher rated the child on a four-point Likert-type scale as not true (1), Sometimes True (2), often true (3), and almost always true (4). SRS-2 covers 5 subscales: social awareness (e.g. "Expressions on his or her face don't match what he or she is saying), social cognition (e.g. "Takes things too literally and doesn't get the real meaning of a conversation"), social communication (e.g. "Gets frustrated trying to get ideas across in conversations"), social motivation (e.g. Does not join group activities unless told to do so") and restricted interests and repetitive behaviour (RRB; e.g. "Thinks and talk about the same thing over and over"). The SRS-2 includes separate norms for parents and teachers, and different scores for males and female. A total t-score was calculated and interpreted as being within the normal range (below 60), mild (60-65), moderate (66-75) or severe range (75 or above).

The SRS-2 was chosen over the Social Communication Questionnaire (SCQ, Rutter, Bailey & Lord, 2003) because it provides more updated relevant autism symptomatology than the SCQ. Furthermore, the SRS-2 has 2 sub-scales, 'social communication and interaction' and 'restricted interests and repetitive behaviour', which are compatible with the latest DSM-5 criteria for autism.

The SRS-2 shows good psychometric properties. It has high rates of internal consistency with alpha = .95 (Lyall, 2011, cited in Constantino et al., 2013, p.54) and test-retest reliability with r = .90. Furthermore, Constantino et al. (2007) showed that inter-rater reliability was .72. The SRS-2 measures the social impairment features for the children with ASC. Higher scores on the SRS-2 show more impairment in social features. As such, the SRS-2 represents a good instrument to evaluate improvement, if any, the children with ASC in this study have made in relation to aspects of their features of social impairment.

3.9.3. Qualitative measure:

Qualitative data was obtained during phase two (December 2015) through semi-structured interviews. The qualitative data was essential to this study because of its potential to provide insight into the processes of the Lego® therapy implementation and to identify the elements which facilitated or impeded the implementation of the Lego® therapy. Moreover, rich data of this nature could help the researcher to gather information regarding the participants' performance and explore how their performance might potentially relate to the impact the intervention.

Semi-structured interview:

Lofland and Lofland (1995, p.18) define the research interview as a 'guided conversation whose goal is to elicit from the interviewees rich, detailed material which can be used in data analysis.' The research interview is able to provide data which is far more in-depth than other methods of data collection, for example questionnaires.

Semi-structured interviews were used because such guided conversations can be conducted in a fluid and dynamic way, and allowed the researcher to explore more thoroughly the topics of interest (Cohen et al., 2007). In contrast, structured interviews are more prescriptive in the questions which are asked. Semi-structured interview appeared to fit well with the current research study, where topics about how Lego® therapy may impact on participants need to be covered flexibly. In order to explore the research questions, semi-structured interviews allowed the researcher to ask open questions, respond and be led by the answers of the interviewees while remaining exploratory. Questions were also designed to explore a range of themes through open questions closely linked to the research questions. These themes formed the basis for the discussion with TAs to ensure consistency.

The interview schedule was piloted with a school SENCo in October 2015, who had experience of running Lego® therapy, and changes were made accordingly to improve the schedule:

General view: Aimed to explore TAs' general perceptions of delivering Lego® Therapy, whether they found it challenging or beneficial.

Children's performance: Aimed to explore TAs' perception of participants' engagement and behaviour throughout the whole intervention.

Impact: Aimed to explore whether TAs had noticed any changes in the participants throughout the whole intervention and outside the session.

Practicality: Aimed to explore TAs' perception of the practicality of running the Lego® therapy in school.

Six TAs who ran the Lego® therapy groups were interviewed. In this project, since all the interviewees were in charge of running Lego® therapy and being the key person who was responsible for the intervention, they may have perceived the interview to be part of an evaluation of their work, introducing potential bias within the views and opinions-expressed within the interviews. However, there were a number of advantages of interviewing the person responsible for delivering the Lego® therapy, as follows; (i) Qualitative data has not been collected from the implementer of Lego® therapy in any published research as yet; (ii) TAs have detailed understanding of the children's performance in the group and the practicality of running Lego® therapy in school; (iii) the process of implementation in educational contexts could be explored and shared with other schools and professionals for future references.

The researcher was aware of the potential bias, leading to a cautious approach to the collection and analysis of the data. Considerable emphasis was placed on

ensuring that the interviews questions were phrased clearly and were formulated in an open manner to avoid leading the interviewee to any specific response (See appendix 5 and 6 for the interview questions and interview consent form).

3.10. Lego® therapy intervention fidelity:

Intervention fidelity is defined as the degree to which key components of interventions are provided as intended (Mowbray, Holter, Teague, & Bybee, 2003). Perepletchikova and Kazdin (2005) stated that fidelity is needed for accurate interpretation of treatment effects, and this was a key factor when investigating impact within the current study. Furthermore, given that Lego® therapy was initially used and examined in a clinic based setting (LeGoff, 2004; Owen et al., 2008), there was a risk that the intervention would not be implemented as planned in an educational context. Moreover, an intervention fidelity check was particularly crucial in this study because Lego® therapy was implemented in 6 groups by 6 different TAs, where TAs' experience of carrying out intervention and working with children with ASC varied. Therefore, it was important to examine whether the intervention was delivered according to the established protocols and whether variations might need to be taken into account when conclusions were drawn from the research findings (Beiline et al., 2007).

Mowbray et al. (2003) have highlighted ways that studies can support intervention fidelity. These include:

1. A training program manual which includes structure of the programme

2. A systematic measure of the program fidelity, such as checklist and observation
3. Training and support for the implementer
4. Validating fidelity using the fidelity measures.

The current study aimed to follow these guidelines to promote intervention fidelity. The training program was created based on the SLT's Lego® therapy materials (J. McCrory, Personal communication, June 10, 2015), LeGoff et al.'s (2014) Lego® therapy training manual and Brett's (2013) training manual. A session checklist was modified by the researcher based on the LeGoff et al.'s (2014), Owen et al. (2008) and Brett's (2013) evaluation form and TAs were required to complete the form after each session (See appendix 7 for session checklist). TAs were also told to complete all the elements in the checklist during the session in order to maintain intervention fidelity. Furthermore, the researcher delivered the first session with the TA in order to demonstrate and support the appropriate way to run a session. In the fifth session, the researcher observed the sessions and provided further support if the TA required it. This ensured the quality of delivery of Lego® therapy by the TAs and also established whether they had demonstrated the components specified during the intervention training.

3.11. Data Analysis:

3.11.1. Quantitative data analysis:

SPSS version 22 for Window was used to conduct all the statistical analyses. Before analysing the cognitive profile of the participants with ASC and outcome

measures, these data were examined to ascertain whether they met the parametric assumptions by using the Shapiro-Wilk test. This would determine whether the data was normally distributed and therefore whether it was feasible to use parametric test for further analysis.

Cognitive profiles of the participants with ASC were compared by using one way ANOVA to examine whether there were any differences between the three groups. Pre-intervention and post-intervention data from the POPE and the SRS-2 were analysed by using an Analysis of Covariance (ANCOVA) to test if the changes in these scales were significant. According to Dancey and Reidy (2007), ANCOVA is recommended because '*pretest score will normally be correlated with the change (difference) score (thus the variation in pretest scores is not removed) (p.439)*' and by using ANCOVA, it is possible to partial out the effect (variance) of the pretest and to focus on possible change following the intervention. The pre-intervention scores were used as the covariate, the group (pure, mixed and control) were the fixed factor and the post-intervention scores were used as the dependent variable.

ANCOVA is reasonably robust to violations of the parametric assumptions (Maronna, Martin, & Yohai, 2006). Therefore, ANCOVA was then used to provide the full statistical model. The researcher was aware of the small sample size of the study and therefore a non-parametric test was also conducted. The differences between pre-intervention and post-intervention ratings for all the scales in the POPE and SRS-2 were calculated. The differences were then tested by using Kruskal-Wallis one–way analysis of variance in order to further

confirm whether there was any difference between the three groups. Kruskal-Wallis is based on the ranks of the scores, therefore it can be used when the data do not meet the assumptions required for a parametric test.

Lastly, Chi-squared goodness of fit was used to calculate the intervention fidelity data. And a two-way intra-class correlation coefficient (ICC) was employed to analyse the inter-rater reliability.

3.11.2. Qualitative data analysis:

Qualitative data was collected by semi-structured interview with TAs who implemented the Lego® therapy group. Interview data were analysed using thematic analysis. Braun and Clarke (2006) suggested that thematic analysis can be used flexibly in both essentialist and constructionist paradigms. The authors also suggested that it can be used between these two paradigms, which make thematic analysis an appropriate tool for mixed methods research designs. Themes within data can be analysed with either inductive or deductive approaches. According to Braun and Clarke (2006), an inductive approach means the identification of themes are driven by the data. On the other hand, a deductive approach means the identification of themes are driven by the researcher's theoretical or analytic interest. The current research was an exploratory study focusing on the effectiveness and implementation process of Lego® therapy, where an inductive approach was adopted. The process of thematic analysis followed Braun and Clarke's (2006, p.87) six phases guideline:

Phase one: familiarising yourself with your data

The researcher listened to the interview and transcribed the script himself. He repeated the process of reading the transcript in order to familiarise himself with the material. The researcher also began to take notes and consider potential codes which were useful for later phases, such as '*there was a child who did enjoy being he supplier a bit too much*' and the researcher wrote down, "*unwilling to change role*" as note.

Phase two: Generating initial codes

The researcher identified a few areas of discourse which were informative and meaningful. Braun and Clarke (2006: p.88) suggested that "codes identify a feature of the data" (semantic content or latent) that appears interesting to the researcher, and refer to "the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon". Initial codes were generated from specific phases, e.g. "*he became more confident in that area and as the weeks went he was more willing to do different roles as well"* and this phase was given an initial code of "positive change in self-confidence and flexibility".

Phase three: Searching for themes

The data was coded and organised. According to Braun and Clarke (2006), the researcher should analyse the data at the broader level of themes, rather than codes. The researcher organised different codes into potential themes and collated all the related coded data extracts within the identified themes. A collection of themes and sub-themes should be established at the end of this

phase. Potential themes were generated, e.g. “Positive changes in social interaction skills”, “Children working collaboratively” and “Importance of room arrangement”.

Phase four: Reviewing themes

In this phase, the researcher reviewed and refined the themes repeatedly. Some themes were discarded because of insufficient support. Two themes were combined where there was some overlap. Braun and Clarke (2006) stressed that it is important to create clear distinctions between different themes and ensure the themes are meaningful to the research. In addition, a ‘thematic map’ was then created to reflect meanings evident in the data set as a whole. As one of the theme selection criteria was having at least 3 TAs to describe the codes. Therefore, some initial themes, such as “children working collaboratively”, were waived as they had less than 3 TAs support. In addition, some of the themes showed similar properties, such as “*Expressive language difficulties*” and “*Receptive language difficulties*”, and they were combined into “*Language difficulties*” in order to refine the themes.

Phase five: Defining and naming themes

Themes were defined and further refined when an agreeable thematic map was established. The researcher gave each theme a detailed analysis and identified the ‘essence’ of each theme and lastly, named each theme with a concise and informative title. After grouping relevant sub-themes together, a theme name was

given, such as "*Practicality of running Lego therapy in school*", which consisted of two sub-themes, "*Room and resources*" and "*Future improvement*".

Phase six: Producing the report

The researcher created a set of fully worked-out themes and began to write-up these themes. The main purpose of this phase was to create a report that was clear and logical to the reader.

Validity of thematic analysis:

A selected sample of coded transcripts was discussed with 3 other TEPs in order to increase the validity of the codes. These TEPs also coded the sample transcripts separately and were cross referenced with the researcher's initial codings. This process helped the researcher to collect opinion from other people and adjusted the coding as required.

3.12. Ethical considerations:

The project followed the British Psychological Society Code of Ethics and Conduct (2006). Ethical approval was granted by the Department of Psychology and Human Development, Ethics Committee, UCL Institute of Education, University of London (Appendix 15). A summary of the specific ethical considerations which related to this study and how the research considers them are discussed below:

Confidentiality:

For all consent forms, the participants were told any information included was confidential and that responses would be anonymous in the final report. The names of all the participants and the TAs were changed in order to protect their identity. The storage of the data, within a locked cabinet, was also guaranteed.

Informed consent:

Participants were recruited from a number of mainstream primary schools. Participants' parents signed the consent form confirming that they had the opportunity to read through the content of the project and agreed to the participation of their child in this project. The consent form included confirmation that participation was voluntary and that participants could withdraw from the study at any point without needing to provide a reason. In the first session of Lego® therapy, children participants were told the context of the training and they were informed that they could withdraw from the training at any point without needing to provide a reason. All children agreed and understood and TAs provided further explanation of the context of training to confirm their understanding and reiterated their right to withdraw. In addition, each TA signed a consent form confirming that they had the opportunity to read through the information sheet and understood the purpose of the interview.

Potential risk associated with the Lego® therapy intervention:

The researcher was aware that the weekly Lego® therapy sessions would provide a different context within the participants' social environment. The researcher recognised the potential for distress associated with a different social situation.

The participants were therefore invited to attend the session and informed that they were able to leave the sessions at any time. Sessions were also run by familiar members of school staff. If participants were reported to be agitated or anxious during the study, a short break was provided. Participants were also offered to carry on or terminate the session. Any incident would be reported to the SENCo, teacher and supervisor.

Potential risk associated with the measures used:

The researcher recognised the potential for distress associated with participants being observed within the playground. All observers were had DBS checked and school staff was informed in advance about the second observer. Observers tried to be as unobtrusive as possible. Those conducting the observations required knowing their way around schools and able to put teachers and pupils at ease, avoid passing judgements, and use the observation schedule as intended.

Debrief:

At the end of the study, all relevant stakeholders were given the overall finding as part of debriefing procedure (See appendix 8 for debriefing details).

4. Results

4.1. Chapter introduction:

This chapter begins by presenting an initial data analysis, which includes an examination of the quantitative data to determine whether it met the four assumptions of parametric data followed by an examination of the cognitive profiles of the participants with ASC across the three groups. It will then report results related to between group differences on the outcome measures. The third section will report the qualitative data from the TA interviews. In the fourth section, four cases will be presented for further examination by integrating quantitative and qualitative data collected in order to better understand how specific participants responded to Lego® therapy. Lastly, the investigation of the programme fidelity will be presented.

4.2. Initial data analysis:

4.2.1. Normality test:

All the quantitative data were tested to see about whether they met the four assumptions of parametric data. The normality of the data was analysed by using the Shapiro-Wilk test of normal distribution. There were 9 of the 9 WASI-II data sets, 15 of the 18 POPE data sets and 35 of the 36 SRS data sets that were not significantly different from normal distribution ($p>0.05$) (Appendix 9: Shapiro-Wilk Test). ANCOVA was used to provide the full statistical model and due to the small sample size, a non-parametric test, the Kruskal-Wallis test, was also used

on the change score between pre-test and post-test to ensure the results were reliable.

4.2.2. Wechsler Abbreviated Scale of Intelligence 2nd edition (WASI-II)

Cognitive profiles of the participants with ASC between the three groups were examined at the pre-intervention period. An understanding of their cognitive ability needed to be developed because if there were any differences, such as verbal ability or non-verbal reasoning ability, this may have affected the interpretation of the data.

The performance of all the participants with ASC on the WASI-II tasks were converted into standardised scores. All participants met the inclusion criterion of IQs greater than 70. Table 4 illustrates the means, standard deviations and range of scores for the 3 groups. The mean of Full Scale IQ (FSIQ), verbal comprehension index (VCI) and Perceptual Reasoning Index (PRI) between the pure, mixed and control groups were analysed using one-way ANOVA. It revealed that there was no statistically significant difference in the mean of FSIQ, VCI and PRI between the three groups [FSIQ *(F(2,18) =2.24, p = .14);* VCI *(F (2,18) = 2.47, p = .12*); PRI (*F (2, 18) = .72, p= .50*)]. Analysis of WASI-II scores suggested that the 3 groups were comparable in terms of the cognitive profiles of participants with ASC.

Table 4 Means, standard deviations and range of scores of the WASI-II scores for the pure, mixed and control groups

WASI-II	Group	Mean	Standard Deviation	Range
Verbal Comprehension Index (VCI)	Pure Group	84.67	7.99	73-94
	Mixed Group	85.63	11.69	72-106
	Control Group	98.00	13.09	84-112
Perceptual Reasoning Index (PRI)	Pure Group	88.17	5.76	79-100
	Mixed Group	95.75	11.12	78-120
	Control Group	94.60	11.67	75-116
Full Scale IQ	Pure Group	85.50	8.23	79-97
	Mixed Group	91.25	12.08	76-104
	Control Group	98.80	16.00	82-116

4.3. Overview of the POPE measure outcomes:

There are seven social interaction states in the POPE and as mentioned in the methodology section, these were grouped into 3 levels: the non-social level includes solitary and proximity; the low-social level includes onlooker, parallel play and parallel aware; the high-social level includes games and joint

engagement. Appendix 10 shows the descriptive statistics of these seven states across the three groups.

Table 5 below is a summary for the three levels of social interaction collected using the POPE. The findings compared the pre-intervention total scores to the post- intervention total scores for each group. The table also reports the mean and standard deviation of the pure, mixed and control groups.

The frequency of non-social behaviour decreased in all three groups at post intervention. All three groups showed an increase in the frequency of low-social behaviour, while the pure group showed the lowest degree of change. The frequency of high-social behaviour increased in the pure and mixed groups while the control group decreased. Initiation of interaction was also collected by the POPE; it revealed that both the pure and mixed group showed an increased rate of initiation while the control group decreased at post intervention. Lastly, the mixed group showed a mild decrease in the frequency of responding to interaction; in contrast, an increase was observed in the pure and control groups at post intervention.

Table 5 Means, standard deviations and differences in all the variables in the POPE observation measure at pre-intervention and post-intervention across the pure, mixed and control groups

		Pure			Mixed			Control		
Variable	**Period**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**
POPE – Non-social behaviour	Pre	6.33	4.13	6	15.00	8.19	8	11.40	7.99	5
	Post	5.17	3.97	6	12.00	7.96	8	10.00	5.96	5
	Difference	-1.16	-.16		-3	-.23		-1.4	-2.03	
POPE – Low- social behaviour	Pre	11.67	4.76	6	5.88	3.44	8	6.20	1.92	5
	Post	11.83	2.71	6	7.25	3.65	8	8.60	.89	5
	Difference	.16	-2.05		1.37	.21		2.4	-1.03	
POPE – High- social behaviour	Pre	12.00	3.57	6	9.13	7.04	8	12.40	7.06	5
	Post	13.00	3.90	6	10.75	5.68	8	11.40	5.32	5
	Difference	1	.33		1.62	-1.36		-1	-1.74	
POPE- Participants' initiation of interaction	Pre	7.33	3.33	6	5.25	3.85	8	7.40	3.05	5
	Post	8.67	1.86	6	6.38	3.62	8	5.20	1.64	5
	Difference	1.34	-1.47		1.13	-.23		-2.2	-1.41	
POPE- Participants' response to interaction	Pre	3.67	2.42	6	3.63	2.67	8	4.00	2.12	5
	Post	5.17	1.33	6	3.13	2.36	8	4.40	1.52	5
	Difference	1.5	-1.09		-.5	-.31		.4	-.6	

4.4. Between group analysis

Analysis of Covariance (ANCOVA) was performed to evaluate the changes in scores from the POPE and the SRS-2 immediately after the Lego® therapy had

finished. The pre-intervention scores were used as the covariate and the group (pure, mixed and control) was the fixed factor. Due to the small sample size, differences of the variables between pre-intervention and post-intervention across the three groups were also analysed by using a non-parametric method, the Kruskal-Wallis test. This was included to increase the reliability of the findings.

4.4.1. Between group difference on the mean frequency from the POPE at Pre and Post period

The mean frequency of the three levels of social interactions, initiation and response to interaction were entered as the dependent variable. ANCOVA revealed no statistically significant intervention effect for the changes in the pure, mixed and control groups [Non-social behaviour: *F(2,15) = .55, p=.588;* Low-social behaviour: *F (2,15) = 1.52; p=.251;* High-social behaviour: *F (2,15) = .401, p=.678;* Initiation of interaction: *F (2,15) = 2.41, p=.123; Response to interaction: F (2,15) = 3.27, p=0.0667]*

The non-parametric Kruskal-Wallis test, also revealed that no statistically significant difference was found in the changes between pre-intervention and post intervention measures across the three groups [Non-social behaviour: *H(2) = .645, p=.725;* Low-social behaviour: *H (2) = 2.057, p = 0.358;* High-social behaviour: *H(2) = 1.903, p = .386;* Initiation of interaction: *H(2) = 3.49, p=0.175; Response to interaction: H(2) = 2.80, p = 0.247].* These variables are presented graphically in Figure 2 to Figure 6.

Figure 2 The mean frequency of non-social behaviour at pre- intervention and post intervention for participants with ASC

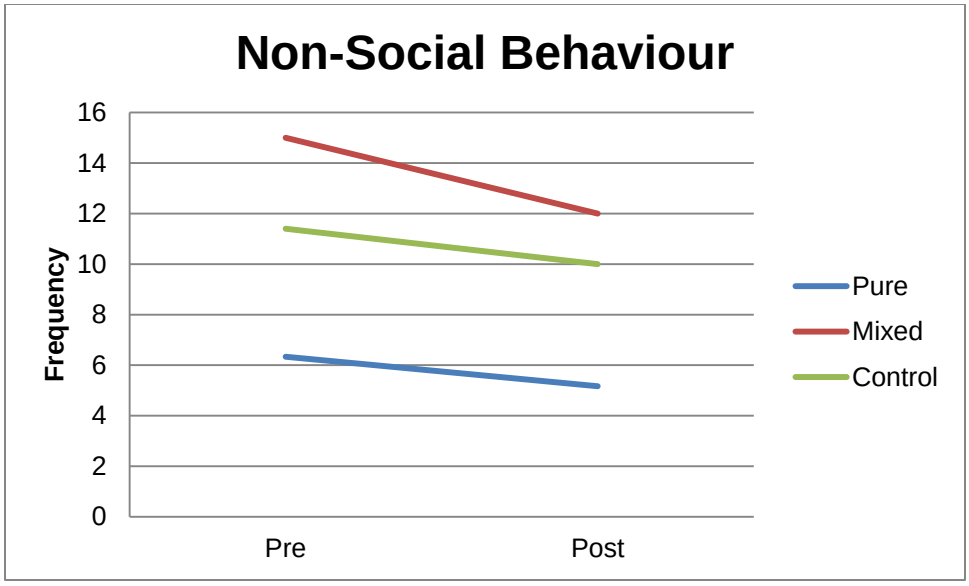


Figure 3 The mean frequency of low-social behaviour at pre-test and post-test for participants with ASC

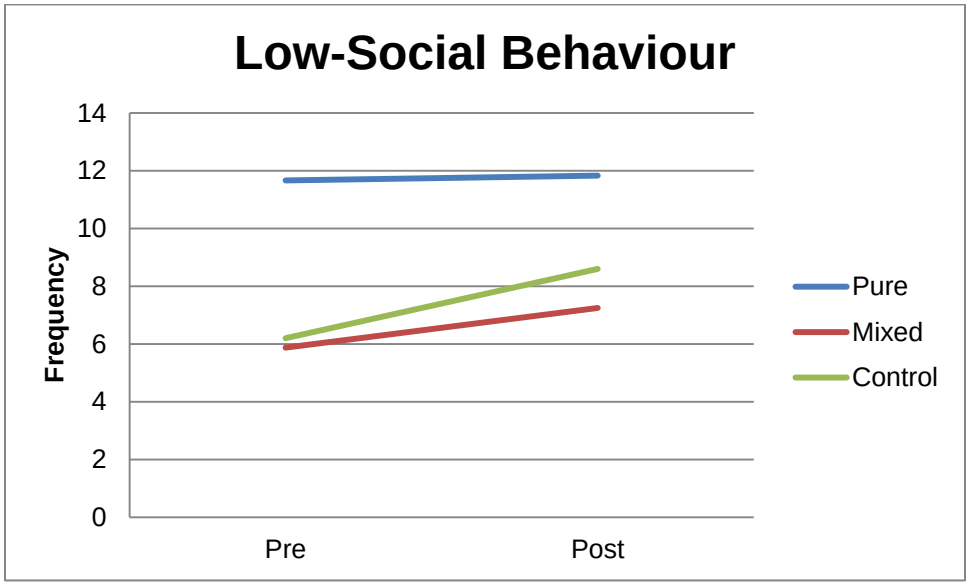


Figure 4 The mean frequency of high-social behaviour at pre-intervention and post-intervention for participants with ASC

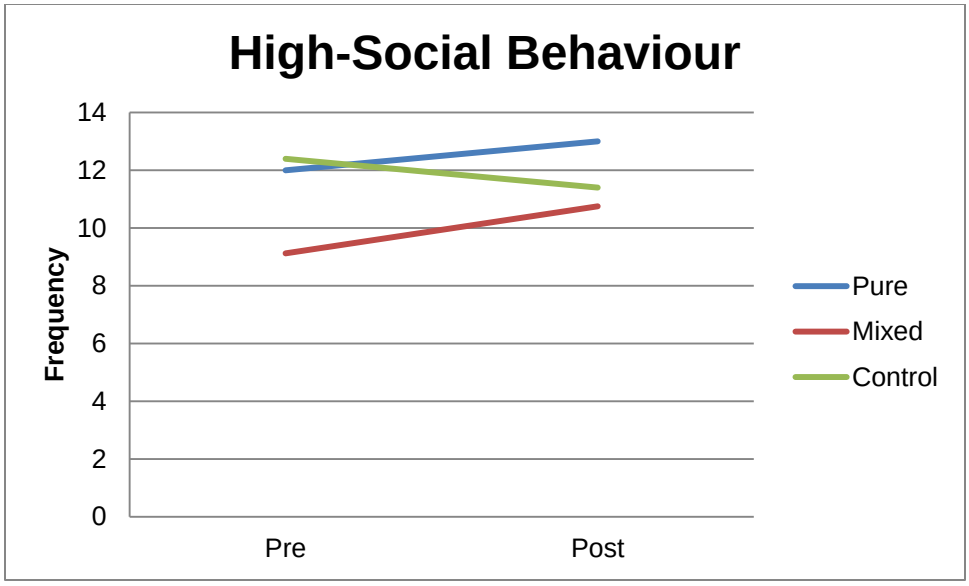


Figure 5 The mean frequency of initiation of interaction at pre-intervention and post-intervention for participants with ASC

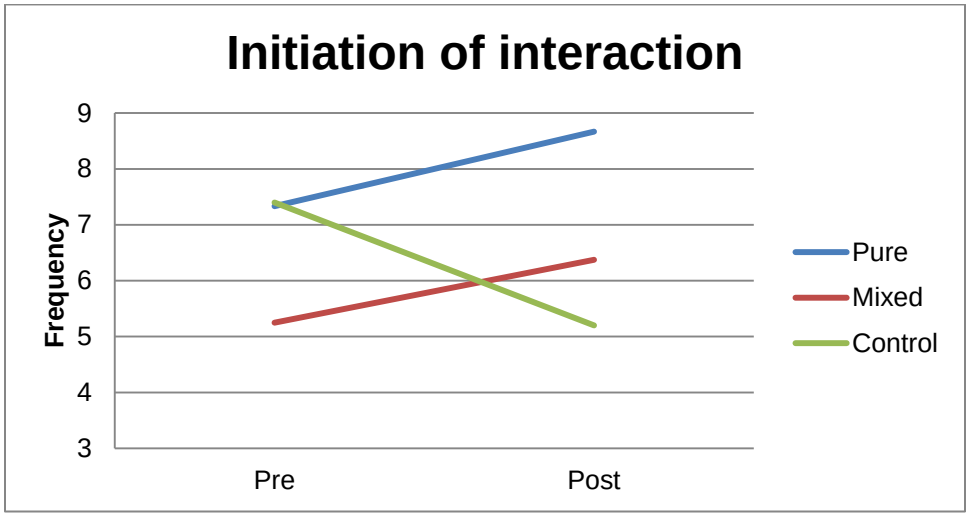
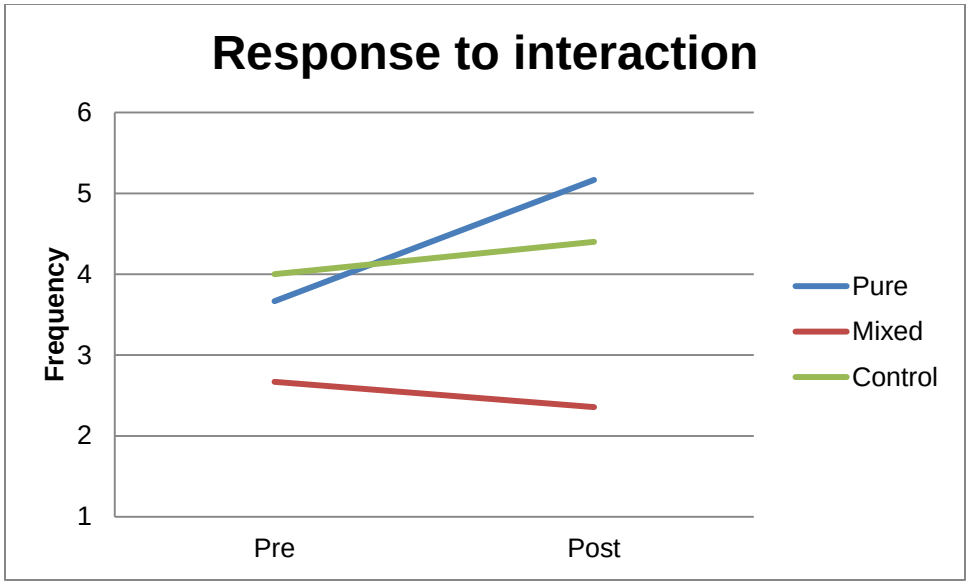


Figure 6 The mean frequency of response to interaction at pre-intervention and post-intervention for participants with ASC



Summary results for RQ1.1: Do the levels and frequency of social interaction of participants with ASC in the playground improve as a result of attending the Lego® therapy?

The POPE data indicated that children with ASC in the pure and mixed groups did not show any statistically significant differences in the levels and frequency of social interaction when compared to children with ASC in the control group after receiving 8 weeks Lego® therapy. It also suggests that Lego® therapy did not affect the levels and initiation/response rate of social interaction of participants with ASC in the playground as measured by the POPE.

Summary of findings for RQ 2.1: Does participation of a TD child in the Lego® therapy group impact upon the social interaction in the playground of children with ASC?

These findings also indicated that children with ASC in the mixed group did not show any statistically significant differences in the levels and frequency of social interaction when compared to children with ASC in the pure group after receiving 8 weeks Lego® therapy. It suggests that the participation of a TD child in the Lego® therapy group has no effect on the levels and initiation/response rate of social interaction of participants with ASC in the playground as measured by the POPE.

4.4.2. Between group difference on the SRS-2 scores at the Pre and Post period

The SRS-2 was used to evaluate the social impairment features in children with ASC after the Lego® therapy intervention. Total and subscale scores of the SRS-2 were analysed by using ANCOVA. There were no statistically significant differences between the pre-intervention and post-intervention in total and all the subscales scores of the SRS-2 [SRS-2 total score: *F (2,15) = 1.793, p=0.200; SRS-2 social-awareness: F (2,15) = 1.85, p=0.192*; SRS-2 social cognition: *F (2,15) = 1.601, p=.234;* SRS-2 social communication: *F (2,15) = .706, p=.510;* SRS-2 social motivation: *F (2,15) = .110, p=.896*; SRS-2 RRB: *F (2,15) = 1.49, p=0.257].*

These results were also confirmed by the Kruskal-Wallis test, where the changes between pre-intervention and post-intervention for all the SRS-2 total and subscale scores across the three groups did not show statistical significant differences [SRS-2 total score: *H(2) = 3.087, p = 0.214; SRS-2 social-awareness: H(2) = 5.676, p=0.058*; SRS-2 social cognition: *H(2) = 2.547, p = .280;* SRS-2

social communication: *H(2) = .997, p = .607, p=.510;* SRS-2 social motivation: *H(2) = .098, p = .952*; SRS-2 RRB: *H(2) = 1.745, p = .418].* Table 6 shows the mean, standard deviation and differences in the total and all the subscale scores in the SRS-2 at pre-intervention and post-intervention across the pure, mixed and control groups.

Table 6 Mean, standard deviation and differences of the SRS-2 results at pre-intervention and post-intervention across the pure, mixed and control groups

		Pure			Mixed			Control		
Variable	**Period**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**
SRS-2 Total score	Pre	66.50	7.48	6	68.38	8.47	8	69.60	5.03	5
	Post	64.83	6.49	6	69.23	8.03	8	69.00	4.18	5
	Difference	-1.67	-.99		.85	-.44		-.6	-.85	
SRS-2 Social Awareness	Pre	60.00	6.41	6	66.88	7.41	8	67.00	8.28	5
	Post	63.30	6.78	6	65.63	11.22	8	64.20	8.14	5
	Difference	3.3	.37		-1.25	3.81		-2.8	-.14	
SRS-2 Social Cognition	Pre	68.00	7.64	6	65.38	9.02	8	73.00	6.20	5
	Post	65.67	6.15	6	66.63	7.50	8	73.60	6.27	5
	Difference	-2.33	-1.49		1.25	-1.52		.6	.07	
SRS-2 Social Communication	Pre	65.33	7.28	6	66.13	7.70	8	65.80	4.44	5
	Post	64.50	4.97	6	68.25	8.97	8	67.40	5.27	5
	Difference	-.83	-2.31		2.12	1.27		1.6	.83	
SRS-2 Social Motivation	Pre	65.00	8.51	6	66.00	8.14	8	63.80	6.38	5
	Post	62.33	6.44	6	63.75	6.45	8	61.80	4.87	5
	Difference	-2.67	-2.07		-2.25	-1.69		-2	-1.51	
SRS-2 RRB	Pre	64.33	12.05	6	72.13	10.09	8	72.80	10.16	5
	Post	60.50	12.35	6	73.75	11.44	8	74.40	8.23	5
	Difference	-3.83	.3		1.62	1.35		1.6	-1.93	

Summary of results for RQ1.2: Do social impairment features of participants with ASC, when rated by their class teacher, improve after attending the Lego® therapy?

These findings indicate that participants with ASC in the pure and mixed groups did not show any statistically significant difference in their social impairment features when compared to children with ASC in the control group after receiving 8 weeks of Lego® therapy. This suggests that Lego® therapy does not affect the social impairment features of participants with ASC when rated by their class teacher.

Summary of findings for RQ2.2: Does participation of a TD child in the Lego® therapy group impact upon the social impairment features of children with ASC when rated by their class teacher?

These findings also indicate that participants with ASC in the pure group did not show any significant difference in their social impairment features when compared to children with ASC in the mixed group after receiving 8 weeks of Lego® therapy. It suggests that the participation of a TD child in the Lego® therapy group had no effect on the social impairment features of participants with ASC who attended the same Lego® therapy group.

Overall, group analyses for the POPE and the SRS-2 results indicated no statistically significant change in the pure, mixed and control groups over time, on any measures.

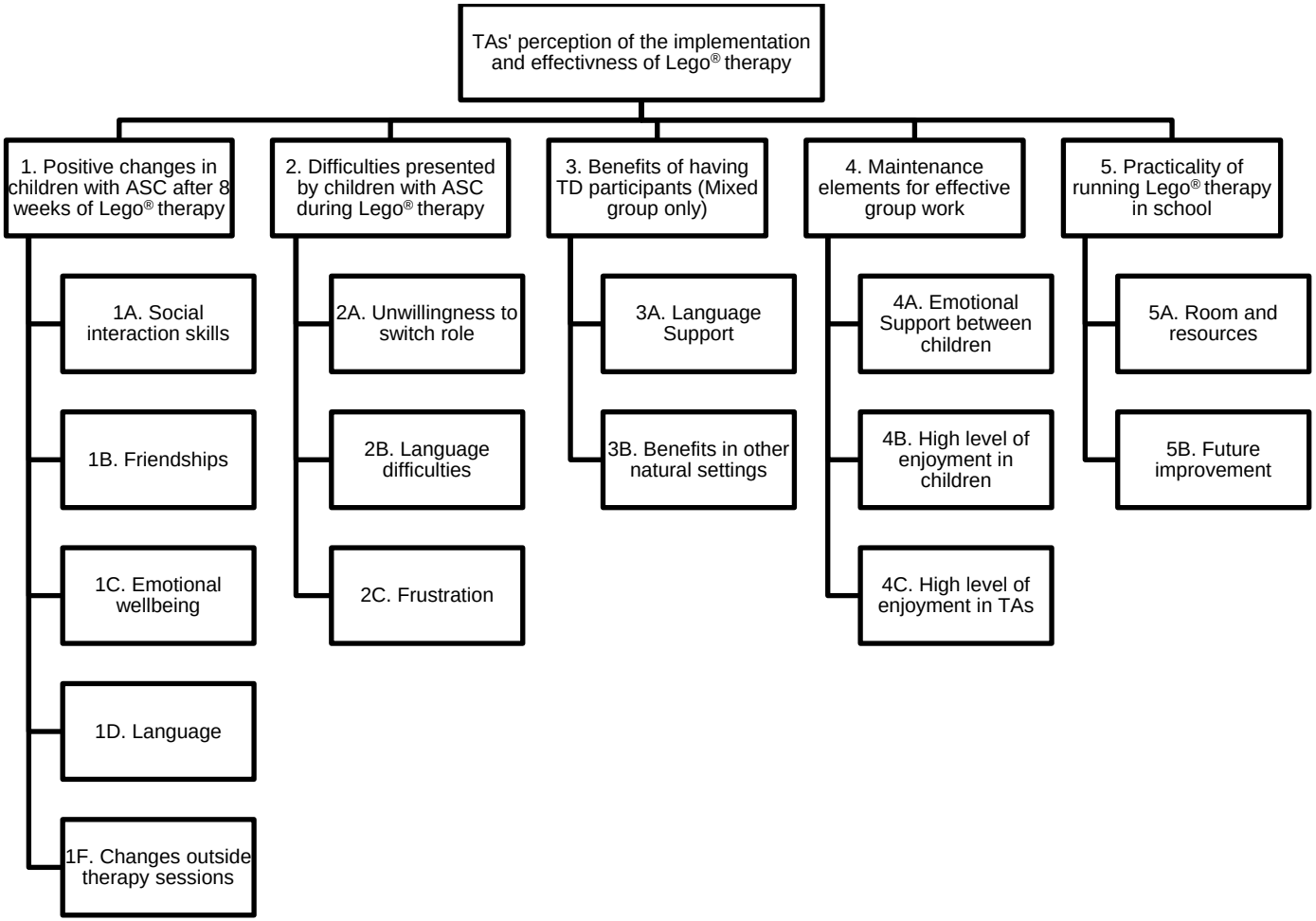
4.5. TA perceptions of the effectiveness of Lego® therapy:

The TA interviews were transcribed as listed in the methodology section 3.8.3. Transcripts from the semi-structured interviews with the 6 TAs in the pure and mixed groups were analysed by using the Braun and Clarke's (2006) six-stage process of Thematic Analysis (See appendix 11 for an example transcript). 5 themes were revealed through the analysis and all subthemes contained extracts from at least 3 TAs. Table 7 shows the five themes that were developed from these interviews. A thematic map is also presented in Figure 7.

Table 7 Themes developed from TAs interviews following Thematic Analysis

Theme No	Theme	No of Subthemes	No of TAs	No of quotes
1	Positive changes in children with ASC after 8 weeks of Lego® therapy	5	6	34
2	Difficulties presented by children with ASC during Lego® therapy	3	4	18
3	Benefits of having TD participants (mixed group only)	2	3	8
4	Maintenance elements for effective group work	3	6	34
5	Practicality of running Lego® therapy in school	2	4	7

Figure 7: Thematic Map



4.5.1. Theme 1: Positive changes in children with ASC after 8 weeks of Lego® therapy

This first theme described the positive changes which TAs noticed in the children with ASC who took part in the Lego® therapy group. Within the first of five positive changes, all the TAs noticed improvement in social interaction skills, making reference to the ways in which children with ASC improved their turn taking, listening and politeness while they interacted with each other in the session. For example:

> ***Dan (TA of Pure group):*** *At first it was like "Well, I thought and I thought" and it was all at once but then they realised "Actually, you need to listen" and take turns between the two.*

> ***Jena (TA of Mixed group):*** *I think with Ty and Zu, their behaviour of taking turns, waiting for one to finish, that has improved a lot.*

Subtheme 1B referred to the friendships which were developed throughout the intervention period, where some of the children would interact and play together more. For example:

> ***Dan (TA of Pure group):*** *As the weeks progressed, you could really see them talking to each other and engaging with each other a lot more. When they built something in free play, they would show each other and say "Come out and have a look at this." They would sometimes work together as a team and they would help each other add things onto a house they were making.*

Liza (Ta of Mixed group): *I noticed that Ben and River would do a lot together, where they would join in and play a bit more together and build things together.*

The third subtheme related to the improvement in emotional wellbeing of the participants with ASC. The TAs described how children with ASC became more confident, better at controlling their frustration and more patient with each other in the group. For example,

Amy (TA of Pure group): *Angel doesn't get as frustrated if he doesn't have that set role. He's able to deal. He will and he does regulate, not initially but then it's fine, because next week, he'll be something different.*

Pa (TA of Mixed group): *She's speaking up a lot more. More confident but also because I think she knows that she'll be listened to so that's quite nice to see.*

Dan (TA of Pure group): *Dominic's eye contact was impressive afterwards and his patience really improved from the beginning. He was one of the kids who was like "Ugh. You need to do it like this" but then as the weeks went on, he was really amazing.*

Improvement in the use of language was also reported by the TAs in subtheme 1D, which reflected on how children with ASC improved their use of language in the session. For example,

Amy (TA of Pure group): *I think the language they were using improved. They just use it more, so they know.*

Jena (TA of Mixed group): *Ty has really come out with the way he has to, when he has to tell about specific Lego®. They're learning about the new words that start on the Lego® and everything, so they are learning about those things. Now, they're familiar with it, they've started using it.*

The fifth subtheme, 1E, illustrated that the TAs noticed some changes outside therapy sessions which suggests potential generalisation of Lego® therapy, such as participants becoming more vocal in the playground and showing better concentration in other small group settings. For example,

Amy (TA of Pure group): *I would say, in their concentration. They're able to focus and concentrate. I work with all of them on their speech and language targets, so two of the boys, Alis and Angel…seem to concentrate better in the small group.*

Liza (TA of Mixed group): *I think Ben is a lot more vocal and speaking to the others. What I've seen in the playground, he seemed to be a lot more vocal, which I was surprised about.*

Overall this theme indicated that participation in Lego® therapy may help the participants with ASC to improve a range of skills within the therapy sessions and some noticeable changes outside the sessions were also noted by the TAs.

4.5.2. Theme 2: Difficulties children with ASC displayed in Lego® therapy sessions

The TAs were asked questions to reflect on the challenges children with ASC faced in the sessions. The interviews revealed that the TAs identified a range of difficulties which children with ASC displayed in the Lego® therapy sessions. Subtheme 2A related to the unwillingness to switch role in children with ASC during the sessions (e.g. "*For Ace, it was just, "No, I want to build. No, I want to build* ***(Trina, TA of Mixed group)****.").* Within some of the quotes there was a sense that children with ASC had difficulty switching role because of their anxiety and inflexibility arising from their condition. For example,

> ***Dan (TA of Pure group):*** *Elton wanted to stick with the one role, that was mainly because he was confident in the role that he was doing. He enjoyed that so that was probably a bit of anxiety in terms of changing his role.*
>
> ***PA (TA of Mixed group):*** *To get the children used to the fact that each week, their goal will change, because quite often, they want a specific role and if they don't get that role, they can get quite upset, which will affect the session.*

'Language difficulties' was another challenging factor reported by interviewees for participants with ASC in the sessions (Subtheme 2B). Some participants with ASC appeared to have difficulties in understanding and giving instructions. There was a sense that this might have affected the flow of the session. For example,

Amy (TA of Pure group): *He is not so good at being the builder, following those instructions, because if he doesn't understand, he wants to see it. He just can't understand.*

Children presenting with language needs required more support from the TAs (e.g. *I have to help Simon to get him around the understanding of where to put the Lego®. Listening to instruction of where to put the Lego® (**Trina, TA of Mixed group)**).*

The third subtheme, 2C, revealed another difficulty which participants with ASC were reported to have in Lego® therapy sessions was managing their 'frustration', For example,

Pa (TA for Mixed group): *He wants to see the plans, and then he'll take the frustration out on that person. "You're not explaining it properly," or "what do you mean?"*

Amy (TA for Pure group): *He can get a bit frustrated, which comes out in the session. He doesn't really understand the instruction and then maybe somebody might laugh because he hasn't understood ... That has come out, which has been a bit challenging.*

Overall, this theme described how the children with ASC found it difficult to engage in the Lego® therapy. These challenges were due to frustration, language difficulties and rigidity/inflexibility in switching roles.

4.5.3. Theme 3: Benefits of including a TD child in Lego® therapy:

There were four mixed groups in the study. 3 TAs in these groups revealed that having TD children in the group showed positive influence on children with ASC. The first subtheme described the way in which TD children provided "language support" in the session, such as breaking down the instruction, remodelling and rephrasing words. For example,

> ***Jena (TA of Mixed group):*** *Brad (TD), if he found someone struggling to .... If other two are struggling to give the Lego®, whichever Lego®. Brad would remodel the words. He would rephrase the words and make it simplifier for them so they understand it.*

> ***Liz (TA of Mixed group):*** *River (TD) would really break down the instruction for the other two to understand. Sometimes it was difficult for Alfan to understand and River would help Ben to explain.*

Subtheme 3B was about "benefits in other natural settings", where TD participants interacted with participants with ASC more in situations other than Lego® therapy sessions, such as the playground, e.g. *"For Ben, I think he is playing a bit more basketball now. Sometimes to play with River (TD;* ***Liz, Mixed group****)."* Another TA noticed the TD participant not only interacting more with the participant with ASC, but also trying to protect the child with ASC, for example:

> ***Pa (TA of Mixed group):*** *I have seen Amari and David play together more at lunch time. Amari is physically really strong. It's why he's on the*

football team, on the basketball team so he is quite a rough boy, but I have seen him looking out on David.

Overall this theme suggested that the participation of a TD participant in the group had a positive impact on the Lego® therapy session and potentially outside the sessions as well. TD participants helped to break down the language instructions into smaller and more manageable chunks for participants with ASC. In addition, it revealed that there were more interactions between TD participants and participants with ASC in other settings.

4.5.4. Theme 4: Maintenance elements for effective group work

There were a number of factors that might have made Lego® therapy a more desirable and effective learning platform for children with ASC. As illustrated in theme 2, children experienced a range of difficulties during the Lego® therapy sessions. Subtheme 4A reflected how the TAs noticed participants would support each other emotionally in the sessions. Children were observed to provide each other with encouragement and bring calmness to the Lego therapy group. For example,

Dan (TA of Pure group): *Elton was very good at supporting the other two, actually. He would really try to motivate them. "You can do this. Don't give up."*

Pa (TA of Mixed group): *He would say something like "Well done. Good work." All of these little things are coming out so that's quite nice.*

Amy (TA of Pure group): *Angel is the calming influence. He tries not to get involved in the argument and he will try to bring them back if that does happen. He's like, "C'mon guys. Otherwise, we're not going to get it finished," which is really nice to see. ..."*

This subtheme suggested that children in the sessions not only worked together, but also supported each other emotionally in order to achieve the group goal.

The second subtheme was about the high level of enjoyment in children participating Lego® therapy. It revealed that they enjoyed Lego® therapy very much spoke highly of the sessions and looked forward to the sessions each week. This appeared to indicate that participants are highly motivated to continue with Lego® therapy. For example,

Dan (TA of Pure group): *They spoke very highly of the session every time it finished. They would walk front and front and I could hear them talking and they were like "Awh. That was so good. That was so good." They enjoyed the free time as well. With each success, they had longer free play with the Lego®. They did pretty much achieve it in good time so they quite a long time for free play.*

Trina (Ta of Mixed group): *They want to keep doing it. I suppose that's a good thing. Say when Monday comes, they know we do it on a Monday, one time we had to rearranged the session because I wasn't in, so when I come they were like, "Oh, we didn't do* Lego®*." I'm like, "Sorry about that."*

They do, they get excited because they can come over here, they get the box, they wait, they read out the instructions.

Not only the children felt motivated, the third subtheme revealed that the TAs were motivated to run the sessions too. It illustrated the enjoyment and motivation that TAs experienced when they ran the session *(e.g. I really love it. Even, I'm really enjoying helping them out, because I can see them verbally, developing their verbal, developing verbally, and with their behavior, they're improving a lot. If it's something to help them out, support them, I'm really happy to do it* ***(Jena, TA of Mixed group)****).* TAs also suggested that because they liked the intervention so much that they would like to run it again in the future. For example,

Amy (TA of Pure group): *I would run it again. Because it's nice to do an activity where they end kind of really happy and proud that they can do something, work together, collaborate, like all of that. It's nice. It's nice to be able to facilitate that.*

Overall, this theme revealed that facilitating factors existed within the therapy group, such as the children participants supported each other emotionally, which potentially helped the sessions go smoothly. In addition, both child participants and TAs were motivated to participate in this intervention. This indicates that Lego® therapy is a motivating intervention which resulted in positive experiences for participants and TAs and was also an intervention they would be prepared to continue the in the future.

4.5.5. Theme 5: Practicality of running Lego® therapy

The TAs were asked about their experience of implementing the Lego® therapy sessions and were specifically asked to reflect on the practicality of carrying them out. The discussions raised the importance of resources and suggestions for future improvement. In subtheme 5A, TAs indicated that resources and room arrangement were important to implementing Lego® therapy (e.g. *we had a room fixed for us. The materials, they stayed always there, which were very helpful* (***Jena, Mixed group***).)

In the second subtheme, TAs suggested further improvement for the implementation of Lego® therapy, such as more sessions and also not restricting participation in the groups to children with ASC only. For example,

> ***Amy (TA of Pure group):*** *I think you can see the children get into it more if it is more of an ongoing thing rather than an 8 or a 10-week intervention. But if it was constant ongoing, and then almost like a term project. I think that would work quite nicely.*

> ***Trina (TA of Mixed group):*** *I would just say that it's not just revolved around autism, like any child could do it if they've got a particular ... even patience or ADHD or any of those kind of thing. Fine motor skills development, handwriting, I would just say.*

Overall this theme indicated that resources and room arrangement were important to implementing Lego® therapy. In addition, TAs suggested that it should not be restricted to children with ASC only and that, children with other

special needs could also be included. Moreover, more sessions could potentially lead to better outcomes.

4.5.6. Summary of qualitative results:

Taken as a whole, the qualitative results suggested that children with ASC responded positively to Lego® therapy and the intervention acted as a supportive space for children with ASC to play and develop different skills. This could be seen through the noticeable positive changes of participants with ASC within the session. Maintenance elements within the sessions were also reported by the TAs. Children not only worked together but also supported each other in order to complete the goal and Lego® therapy was described as an enjoyable activity for both participants and the TAs. This is an important indicative finding because high motivation was regarded as a key element in Lego® therapy in previous research, a factor which will be consider further in the Discussion section.

The participation of TD children in the Lego® therapy sessions was reported to have had a positive impact on participants with ASC. TD children were observed to provide language support in the group and also interacted with participants with ASC more in the playground.

Despite reflections by TAs of positive changes because of the intervention, participants with ASC were also reported to display several difficulties within the sessions. Participants with ASC were reported to have difficulties in their language and communication, managing their frustration and rotating their roles.

These elements are crucial during the implementation of Lego® therapy and will be discussed further in the final Chapter.

Lastly, the practicality of Lego® therapy was discussed revealing that resources and room arrangement were important for TAs to effectively implement Lego® therapy accordingly. TAs also suggested that the number of sessions should be increased and not restricted to children with ASC only.

4.6. Case studies:

In this study, although quantitative results did not show any significant changes on a group level, qualitative results did suggest that some children benefited from Lego® therapy. The researcher was aware of the threat of heterogeneity in the small sample size and the purpose of presenting some case studies was to show individual variations between participants with ASC and how these might affect the outcomes of Lego® therapy. The use of MVSA to select cases allowed the researcher to investigate common patterns that arise from the variation and that may potentially impact on the Lego® therapy (Patton, 2003). The presentation of case studies aimed to compare the quantitative and qualitative results of each selected case in an attempt to understand what the inconsistencies found in the results. The researcher selected a number of cases from participants with ASC who took part in the Lego® therapy and carried out a more detailed analysis on their outcomes. Selection criteria were listed in the Methodology section 3.5. For the selected cases, the researcher compared and examined their quantitative and qualitative data individually. Table 8 shows details of the selected cases.

Table 8: Characteristics of selected cases

Name	School	Gender	Year group	Diagnosis	SRS-2	FSIQ/VCI/PRI	School support	Group	POPE outcomes
Karen	Group C	F	5	Asperger	Mild	102/106/97	IEP, small group numeracy, drama therapy	Mixed	Increased in high-social behaviour and initiation of interaction
Elton	Group A	M	4	Asperger	Moderate	90/88/95	IEP, ST targets, small group literacy	Pure	Increased in low-social and initiation of interaction
Simon	Group E	M	3	PDD-NOS	Moderate	78/73/87	IEP, ST targets, OT, small group literacy and numeracy	Mixed	No significant changes
Alex	Group D	M	4	PDD-NOS	Mild	80/84/79	IEP, ST targets, OT, small group literacy and numeracy	Pure	No significant changes

4.6.1. Presentation of data:

Each case is presented separately with their POPE and SRS results. Each case description consists of the tables which show their data at pre-intervention period, post-intervention period and the difference between the two measures. Qualitative data is then presented, retrieved from the TA interview. The child's name was entered in the 'Find' option in Microsoft Word 2010, which allowed the researcher to identify quotes that related to the focus children. Quotes were categorised into the themes that were developed in section 4.5. If the quote could not be categorised within any of the themes, it was listed as other.

Karen (Mixed group):

Table 9 and 10 provide overall data of the POPE and SRS collected for Karen. Karen's POPE results illustrated that the frequency of her non-social behaviour was decreased by 13 (SD = 8.19) and that there was a 7 point increase in her low-social activities score at post-intervention (SD=3.44). In addition, her frequency of initiation of social interaction was increased by 4 (SD= 3.85). Karen's SRS-2 social awareness and RRB scores decreased by 9 (SD = 10.09) and 11 (SD = 10.09) respectively. Karen's changes in her SRS-2 scores suggested that her class teacher perceived her to be socially more aware and showed less restricted interests and repetitive behaviour following the intervention.

Table 11 presents a qualitative description of Karen's performance in the Lego® therapy sessions from the TA. In total, there were eight quotes that were related specifically to Karen. The TA's view was that Karen showed positive changes in

her emotional wellbeing, such as becoming more confident in speaking out. According to the TA, Karen's class teacher described Karen as more confident in the classroom too following the Lego® intervention. Karen was perceived as an emotional influence in the Lego® therapy group, where she brought in a sense of calm to the group. Despite all the positive comments about Karen, at times she had difficulties understanding instructions from other people in the Lego® therapy group.

Table 9: Karen's POPE results

	Non-social		**Low-social**			**High-social**		**Social interaction**	
Period	**S***	**P**	**OL**	**PP**	**PA**	**JE**	**G**	**Initiate**	**Respond**
Pre	17	4	3	1	1	4	0	4	3
Post	7	1	6	2	4	10	0	8	5
Difference	-10	-3	3	1	3	6	0	4	2
Three levels of social interaction	-13		7			6			

*Solitary (S), Proximity (P), Onlooker (OL), Parallel Play (PP), Parallel Aware (PA), Joint Engagement (JE), Game (G)

Table 10: Karen's SRS results

Period	**Social Awareness**	**Social Cognition**	**Social Communication**	**Social Motivation**	**RRB**	**Total Score**
Pre	70	57	63	57	67	64
Post	61	60	69	54	56	63
Difference	-9	3	6	-3	-11	-1

Table 11: Quotes that were related to Karen

Theme	Quote
1C: Positive changes in ASC participants after 8 weeks of Lego® therapy – emotional wellbeing	Karen actually, last week, my last session when she was the architect, she was loving being in charge. I think in a small group like that, she's quite vocal, she's quite confident. In class, you don't often see that side to her. Karen has become a lot more vocal in the group (confidence) Karen is speaking up a lot more. More confident but also because I think she knows that she'll be listened to so that's quite nice to see.
1E: Positive changes in ASC participants after 8 weeks of Lego® therapy – changes outside Lego® therapy session	I met up with Karen's teacher and just said generally she seems more confident… It's generally just ... Yeah. She's making good progress and her teacher's really happy with her.
2B. Difficulties children with ASC displayed in Lego® therapy – Language difficulties	Karen didn't know what he was talking about from the way he described something
4A. Maintenance elements for effective group work – Emotional support between children	Karen brings something a bit different. I feel like she balances out a little bit between the two boys. She's a bit more relaxed about it, whereas David can be quite, "No. It needs to be like this." And quite rude. She's like, "Oh well, you can try it but then if it doesn't work then ... " Say she's a bit more relaxed about it.
Others	Karen is a funny little creature given some of the stuff she comes out on me. I love it.

Both Karen's quantitative and qualitative results showed similar findings. Within the quantitative data, Karen demonstrated a decrease in non-social behaviour, an increase in low-social behaviour and initiation of interaction, which was

supported by the TA's description of her behaviour, such as "*She is speaking up a lot more. More confident but also because I think she knows that she'll be listened to…".* Furthermore, Karen's social awareness showed sign of improvement, again supported by the TA's description of the way Karen supported her peers in the Lego® therapy group, "*Karen brings something a bit different. I feel like she balances out a little bit between the two boys*. *She's a bit more relaxed about it, whereas David can be quite, "No. It needs to be like this" and quite rude. She's like, 'Oh well, you can try it but then if it doesn't work then ...*'". Karen's quantitative and qualitative results indicated that she appeared to respond positively to Lego® therapy.

Elton (pure group):

Table 12 and 13 present Elton's POPE and SRS-2 results, which compared pre- and post-intervention measures. The changes showed a notable increase in Elton's frequency of his high-social behaviour and initiation of social interaction, by 6 (SD = 3.57) and 7 (SD = 3.33) respectively. Elton's SRS-2 social motivation score was decreased by 9 (SD=8.51), which potentially indicated his class teacher perceived Elton to be socially more motivated at post-intervention period.

The TA interviews offered a qualitative description of various areas related to Elton in Lego® therapy. There were in total 7 quotes which were related to Elton in the interview transcript, they are listed in table 14. Elton was observed to show emotional support to other members in the group, such as motivating others and

bringing calmness into the group. Regarding motivation to participate in the group, Elton was described as the most motivated member in the Lego® therapy group. The TA also reported that Elton showed other positive elements, such as offering support if a group member needed help, demonstrating improved social skills. On the other hand, the TA reported that Elton felt anxious about changing role in the Lego® therapy group.

Table 12: Elton's POPE results

	Non-social		Low-social			High-social		Social interaction	
Period	**S**	**P**	**OL**	**PP**	**PA**	**JE**	**G**	**Initiate**	**Respond**
Pre	3	0	16	0	2	0	9	4	2
Post	1	0	12	0	2	5	10	11	5
Difference	-2	0	-4	0	0	5	1	7	3
Overall difference	-2		-4			6			

*Solitary (S), Proximity (P), Onlooker (OL), Parallel Play (PP), Parallel Aware (PA), Joint Engagement (JE), Game (G)

Table 13: Elton's SRS results

Period	Social Awareness	Social Cognition	Social Communication	Social Motivation	RRB	Total Score
Pre	48	69	67	76	63	68
Post	53	74	72	67	66	70
Difference	5	5	5	-9	3	2

Table 14: Quotes that were related to Elton

Themes	Quotes
2A. Difficulties children with ASC displayed in Lego® therapy – unwilling to switch role	Elton when he wanted to stick with the one role, that was mainly because he was confident in the role that he was doing. He enjoyed that so that was probably was a bit of anxiety in terms of changing his role and/or "Can I be good at this?" There is always that kind of doubt of "Oh, can I do this?"
4A.Maintenance elements for effective group work – emotional support between children	Elton was very good at supporting the other two, actually. He would really try to motivate them. "You can do this. Don't give up" He (Elton) was really calm. He was really helpful towards to the others. He was patient. I mean, they all had elements of this but he stood out as being the one who ...
4B. Maintenance elements for effective group work – High level of enjoyment in children	One child in particular, who stood out, was Elton. He was the most motivated.
Others	Even Elton, during the session, he actually said out loud, "Well, maybe if I try it like this, it might work." His (Elton) eye contact was better than, perhaps, the other two. His turn-taking was, perhaps, slightly better. He didn't go into the other children's space. He wasn't up in their space, whereas, the other two, would be more in your face, more near you. He had a good composure about him. Elton, I think, dominated a bit slightly, in terms of "What role do you want to be? And what role do you want to be? I want to be this." He was very confident in saying the roles that he wanted to be but at the same time, he would listen and Dominic would say "Well, I wanted to be that today." Then Elton would be like "Okay, you can be that."

Elton's quantitative and qualitative results showed a similar pattern of findings. Elton was observed to show a noticeable increase in his high-social behaviour and amount of initiation of interaction. In addition, his SRS-2 results showed that he showed signs of improvement in his social motivation. These findings were complemented by the TA's description of his behaviour in the Lego® therapy group, such as being helpful to others within the group and also being described as the most motivated in joining the group. These findings suggested that Elton appeared to respond positively to Lego® therapy.

Simon (Mixed group)

Table 15 and 16 show Simon's POPE and SRS results, indicating that although there were changes at the post-intervention for both measures, all the changes were within the standard deviations. Therefore, it could be concluded that there was no measurable effect of Lego® therapy on Simon's social interaction and features of social impairment.

Table 17 presents a qualitative description of Simon's performance in the Lego® therapy session from the TA. There were in total 8 quotes which were related to Simon in the interview transcripts. The majority of the quotes were related to Simon's language difficulties. The TA reported that he struggled to understand different instructions and provide the building instructions in the sessions. Moreover, the TA also described Simon as a quiet child in the group, requiring the TA's support in order to communicate.

Table 15: Simon's POPE results

	Non-social		Low-social			High-social		Social interaction	
Period	**S**	**P**	**OL**	**PP**	**PA**	**JE**	**G**	**Initiate**	**Respond**
Pre	7	1	6	0	2	2	12	6	3
Post	8	3	3	0	2	6	8	5	3
Difference	1	2	-3	0	0	-4	4	1	0
Three levels of interaction	3		-3			0			

*Solitary (S), Proximity (P), Onlooker (OL), Parallel Play (PP), Parallel Aware (PA), Joint Engagement (JE), Game (G)

Table 16: Simon's SRS results

Period	Social Awareness	Social Cognition	Social Communication	Social Motivation	RRB	Total Score
Pre	67	70	69	71	75	73
Post	73	65	67	71	79	72
Difference	6	-5	-2	0	4	-1

Table 17: Quotes that were related to Simon

Themes	Quotes
2B. Difficulties children with ASC displayed in Lego® therapy – Language difficulties	It was just Simon to get him around the understanding of where to put the Lego®. Listening to instruction of where to put the Lego®. Just Simon was difficult. In my opinion, it was just obviously Simon as well not getting it sometimes but he was well behaved. Yeah but the actual building, it's very difficult. We've actually had to try, because it would take me probably the whole session. We've actually had to physically say, "No it's there." Simon is the only one that I've had a challenge with. It was just sometimes the frustration of Simon that was it. Say for instance if he was the engineer, they would say what it is and I would have to tell him because I was like, Well, what's that?" Say for instance it was a red square, "How many?" I was like, "I may need some of yours." It's like just to point and he would go, "One, two, three, four, five, six." That was the only thing just a little bit of frustration Obviously Simon yet again, it's just understanding of where to put ... like if someone else was the engineer and they're telling him where to put a red rectangle, he wouldn't know unless you say, "On top," he would put it on top. If you say another then we don't know on the side, overlapping, he wouldn't get that at all.
Others	Simon, he doesn't care what he really gets but engineer was more challenging for him. Simon doesn't really, he's very quiet. I know he didn't know what to do but he's very quiet so it's trying get that out. I would point out the green square or something, then he would say it. It's getting his language out because he was very quiet. He has improved. When I go collect him from the class as well, he knows, "Oh, Lego®." It's like walk over here, say hello, get the Lego®.

The majority of Simon's qualitative data were related to his language difficulties and his difficulty providing and understanding instructions. This may indicate that Simon struggled to participate in the Lego® therapy group and may help explain the insignificant changes within his quantitative data, as Simon's social interaction and social behaviour did not show notable changes after the eight weeks intervention. These findings suggested that Simon did not benefit from Lego® therapy and that this may potentially be associated with his language difficulties.

Alex (Pure group):

Table 18 and 19 show Alex's POPE and SRS results, although there were changes at the post-intervention for both measures, all the changes were lower than the standard deviations. Therefore, it could be concluded that there was no measurable effect of Lego® therapy on Alex's social interaction and the features of social impairment.

There were in total 7 quotes which were related to Alex in the interview transcript, which are listed in Table 20. TA reported that Alex displayed language difficulties, which had influenced his emotions in the session. He wanted to see the "Lego® model sheet" as he struggled to understand the instruction, however, he was not allowed to look at the sheet and became frustrated in the session. In addition, the TA reported that Alex's performance was affected by different events before the sessions, such as conflict with peers during the lunch break. These external factors affected his emotional control in the session. On the other hand, the TA

described Alex as a good engineer and being skilled at instructing other children what to do in the group.

Table 18: Alex's POPE results

	Non-social		Low-social			High-social		Social interaction	
Period	**S**	**P**	**OL**	**PP**	**PA**	**JE**	**G**	**Initiate**	**Respond**
Pre	8	4	2	3	4	7	2	7	3
Post	7	4	6	0	2	4	7	7	6
Difference	-1	0	4	-3	-2	-3	5	0	3
Three levels of interaction	-1		-1			2			

*Solitary (S), Proximity (P), Onlooker (OL), Parallel Play (PP), Parallel Aware (PA), Joint Engagement (JE), Game (G)

Table 19: Alex's SRS results

Period	Social Awareness	Social Cognition	Social Communication	Social Motivation	RRB	Total Score
Pre	63	59	61	56	55	61
Post	61	59	60	56	55	60
Difference	-2	0	-1	0	0	-1

Table 20: Quotes that were related to Alex

Themes	Quotes
2B. Difficulties children with ASC displayed in Lego® therapy – Language difficulties	Alex struggled following those instructions, because if he doesn't understand, he wants to see it. "You're not explaining it properly," or "what do you mean?"
2C. Difficulties children with ASC displayed in Lego® therapy – Children with ASC felt frustrated	Alex, who had a bit of a meltdown, yeah.... Not so good at being the builder… He wants to see the plans, and then he'll take the frustration out on that person. He (Alex) will try to calm down a little bit more when we're in session, but sometimes because it's just a small group, it can make it feel a lot more intense. Yeah, with him, it seems he's just got a bit frustrated, so he's not. Yeah, that control. He does try, but we're not always getting that. (Alex) he can get a bit frustrated, which comes out in the session. He doesn't really understand the instruction and then maybe somebody might laugh because he hasn't understood ... That has come out, which has been a bit challenging.
Others	He's very good as the engineer, in telling the others what to do. Alex, I think that's more what's going on generally with the school. I would say that him ... I think that the one session I had to stop, something that happened at playtime, because I do after lunch. Something had happened at lunchtime. They'd been in a fight, which had then kind of gone in to ... Well, he'd gone back into class. It was still being dealt with and he was still very, very angry, and then he brought it in the session. I came in to it in the session. Sometimes what's going on outside does have an impact on their behavior and definitely with him. He's kind of already up there and if he feels like people are laughing or not listening or he doesn't understand the instruction.

Alex did not show any notable changes in his social interaction or other social behaviour at the post-intervention period. According to the TA's description, Alex's emotions were affected by external events before the Lego® therapy session, which had a negative impact on his engagement in the session. In addition, He appeared to have difficulties managing his frustration when he did not understand instructions or was unable to get the "Lego® model sheet" from the engineer. These findings indicate that Alex's lack of positive response to Lego® therapy may potentially have been due to his difficulties during the session, especially his language difficulties and frustration.

4.6.2. Overall case summary:

Case studies were carried out in order to attempt to explain the discrepancy between quantitative and qualitative results in section 4.3 and 4.4. Cases which appeared to respond positively to Lego® therapy revealed many similarities. Karen and Elton were reported positively by their TAs regarding their performance in the Lego® therapy sessions. The two children were reported to have brought emotional stability to the sessions and to have influenced others positively. They also showed empathetic skills towards others, as they would support other members when required. Moreover, their quantitative results revealed that they both appeared to spend more time playing with other children and initiated more social interactions in the playground. Although their changes in SRS-2 did not show the same pattern of positive changes, both cases had at least one notable change in their SRS-2 subscale scores. This may help explain why their class teachers noticed the differences after the intervention.

On the other hand, cases which did not show improvement in their quantitative data also had a number of factors in common. Both cases were described as having significant difficulties in the Lego® therapy sessions, namely language difficulties or difficulties in managing frustration. These significant challenges may potentially have affected the effectiveness of Lego® therapy for these children.

4.7. Intervention Fidelity

Table 21 shows the frequency and percentage of delivery of each item from the session checklist. Six schools each ran eight sessions and therefore, the maximum frequency per item was 48. In order to explore whether the observed frequency of item existence from the session checklists differed significantly from the expected frequency of existence, a chi squared goodness of fit for test was performed.

The chi square analysis[2] did not show significant differences between observed and expected frequency X^2 *(14, N = 15) = 20.63, p> 0.05,* suggesting that the Lego® therapy did not vary between aspects of the intervention. The total attendance rate of both groups was 100%. Therefore, the overall fidelity to the programme can be considered to be good.

Programme fidelity was also analysed between groups to investigate whether all the participating groups maintained programme fidelity. The chi square analysis showed significant differences between observed and expected frequency from

[2] Chi Square equation: $X^2 = \Sigma (O-E)^2 / E$

different groups X^2 *(5, N = 6) = 15.08, p< 0.05* (Appendix 12 shows the checklist completion for each group). This suggests there were some inconsistencies of Lego® therapy implementation across all six groups. Groups B, D, E and F appeared to have a lower percentage than group A and C. Each group's checklist was further examined in order to identify items that were executed less consistently in some groups. The first six items of the checklist illustrate the basic structure of the Lego® therapy and were similar between groups; however, items 8, 13, 14 and 15 appeared to have lower completion than other items. The completion percentage varied from 63% to 88% in groups B, D, E and F (Appendix 13 illustrates the completion percentage for each item in each school). The rest of the checklists were designed for TAs to scaffold and guide the participants to work together and minimise TAs' direct input. The result indicates that TAs in groups B, D, E and F may have scaffolded less in the sessions.

In sum, the overall intervention fidelity check was considered to be good as the total number of observed items in the programme checklist did not show significant statistical differences to the expected items. In addition, participating rate was 100% across all the schools. However, there was a statistically significant difference in the intervention fidelity check between groups, which suggested some groups did not follow the intervention procedure exactly as intended. This might have potentially affected the results found in some of the participants with ASC, which will be discussed in Discussion section.

Table 21 Overall checklist completion percentage and chi squared calculation

Checklist items	Observed	Expected	Percentage	$(O-E)^2$	$(O-E)^2/E$
1. Lego® rules recapped and displayed	48	48	100%	0	0.00
2. 3 Roles recapped and assigned	46	48	95.83%	4	0.09
3. Structured Lego® building for 30 minutes	46	48	95.83%	4	0.09
4. Freestyle Lego® building for 15 minutes or more	45	48	93.75%	9	0.20
5. Children tidy up Lego®	44	48	91.67%	16	0.36
6. TA summarised and praised	45	48	93.75%	9	0.20
7. Pupils play according to role	41	48	85.42%	49	1.20
8. TA minimises direct support	35	48	72.92%	169	4.83
9. TA praises for good building	45	48	93.75%	9	0.20
10. TA praises for good social skills	41	48	85.42%	49	1.20
11. TA prompts pupils to help each other	40	48	83.33%	64	1.60
12. TA identifies the social problem	43	48	89.58%	25	0.58
13. TA directs the social problem to the whole group	35	48	72.92%	169	4.83
14. Provide opportunity for pupils to problem solve	38	48	79.17%	100	2.63
15. TA reminds strategies that pupils previously created/practised	38	48	79.17%	100	2.63

4.8. Observer inter-rater reliability

In order to confirm the reliability of observations, another TEP conducted 3 concurrent observations at time 1. A comparison of the measurements from two raters was performed so that this could minimise the effect of observer bias and ensure the observation schedule was valid. A two-way intra-class correlation coefficient (ICC) was used to analyse the observation data and illustrate the degree of inter-rater agreement. The ICC was 0.906 ($p<.001$, $r= .95$, $df=34$, $F = 20.19$) which shows a significant agreement between two raters (See Appendix 14).

5. Discussion

5.1. Chapter introduction

This chapter will summarise and provide an in-depth discussion of the findings of the study by interpreting these results in the light of issues raised in the literature review and decisions made about the research design. Experimental quantitative findings in terms of social interaction and features of social impairment will be discussed in relation to their corresponding research questions. Qualitative findings regarding TA perceptions of the Lego® therapy will be referred to throughout the discussion as a qualitative narrative account to add credibility to quantitative findings. Furthermore, the case study findings will be integrated into each research question in order to provide more in-depth information. Lastly, the thesis will conclude by considering the limitations of the research, professional implications and areas for future research.

5.2. Study aim:

The study investigated the effectiveness of an 8-week Lego® therapy intervention in promoting children's social interaction and improving features of social impairment. In addition to this, an examination was also conducted into the effectiveness of including a TD child in the Lego® therapy group. Three types of investigation were carried out: Firstly, a quasi-experimental study measuring the social interactions and features of social impairment of participants with ASC. Secondly, a qualitative investigation involving a semi-structured interview with the TAs (who carried out the 8 weeks Lego® therapy), focusing on the process of the

implementation and the children's performance, took place. And finally, four cases were selected by using a MVSA attempting to look for information that could explain variation in the intervention outcomes.

5.3. Research questions

5.3.1. RQ1a: Do the levels and frequency of social interaction of participants with ASC in the playground improve as a result of attending the Lego® therapy?

Social interactions were measured using the POPE (Kasari et al., 2010) during lunch time in the playground. Although the frequency of high-level social behaviour and initiation of interaction showed an increasing trend in the pure and mixed group while control group showed a decreasing trend on both scales, there was no statistically significant change found in the levels or frequency of social interaction of participants with ASC. The findings of the current study did not confirm those found by LeGoff (2004) and LeGoff and Sherman (2008), who showed that 12 and 24 weeks of Lego® therapy led to an increase in self-initiated interactions. Although the shorter 8 week intervention timescale might be provided insufficient time for sustained change to occur, the insignificant group effects might indicate that the intervention yielded no effect on the levels of frequency of social interaction. Although it appeared that Lego® therapy did not show statistical association with social interaction, the TAs' qualitative post-intervention data provides some evidence of positive changes in social interaction skills of some participants with ASC.

Taubman et al. (2011) stated that initiation of social interaction needs to be planned and individuals must have sufficient social understanding to organise their actions and thoughts in order to have the opportunity to engage socially. Lego® therapy is a play-based intervention which does not include teaching social interaction or other social rules explicitly. It is possible that the intervention did not provide sufficient direct teaching about social skills knowledge for some participants with ASC in order to help them to engage in other social activities. Gillis and Butler (2007) suggested that when teaching social skills to children with ASC, the facilitator/therapist needs to specify the element of social skills so that the children with ASC have a clear understanding of the activity. Lego® therapy is designed for promoting social interaction under a structured collaborative play setting and it does not include specific and explicit teaching in skills for social interaction. Thus, some of the learned skills may not have generalised to other contexts.

In contrast, Lego® therapy appeared to support the children with ASC to develop some basic social interaction skills. According to Taubman et al.'s (2011) levels of social interaction, the basic level refers to being attentive and responsive to the initiations of others. The findings of the current study indicated that participants with ASC showed improvement in these foundation skills. In subtheme 1A, TAs reported that they noticed positive changes of social interaction skills in participants with ASC, such as improvement in turn taking, listening and responding. This indicates that Lego® therapy has potentially helped some participants with ASC in this study to develop some foundation skills before

moving to the intermediate level, the initiation of interaction (Taubman et al., 2011).

One of the cases that demonstrated no significant change following Lego® therapy (Simon), had significant language difficulties. Although one of the recruitment criteria of this study was having an IQ of 70 or above, it appeared that Simon still struggled with understanding language instructions given within the sessions. Asberg, Dahlgren and Sandberg (2012) reported that children with ASD are more likely to have difficulties in oral language comprehension. The deficits of ToM have also been noted to compromise language comprehension, together with the ability to make inferences regarding the speaker's communicative intentions in the speech (Baron-Cohen, 2000). Lastly, Jones et al. (2009) showed that greater comprehension difficulties were associated with more pronounced social and communication impairments in individuals with ASC. These deficits may have had a significant impact on Simon's ability to benefit from Lego therapy. Lego® therapy may be therefore more suitable for children with mild language needs, and not those with language difficulties as significant as Simon's. Furthermore, subtheme 2.1 illustrated that language difficulties were a key difficulty that some participants with ASC experienced in the sessions. As a result, it can be concluded that underdeveloped language ability may serve as a potential barrier for participants with ASC to gain optimum benefit from this intervention.

5.3.2. RQ1b: Do features of social impairment of participants with ASC, when rated by their class teacher, improve after attending the Lego® therapy?

Analysis of the SRS-2 data showed that there was no significant difference in the features of social impairment of participants with ASC after the intervention across the three groups. It indicated that in this study, teachers' perception of the social related difficulties of participants with ASC did not show a change after the 8-week intervention across the three groups. This study did not confirm LeGoff and Sherman's (2006) and Owen et al.'s (2008) findings, where participants in their Lego® group made significant improvements in measures of socialisation and autistic behaviours.

Waltz (2013) stated that children with ASC experience challenges generalising skills learnt between contexts. In addition, research suggests that PMI without direct instruction from teacher/facilitator does not lead to skills generalisation (DiSalvo & Oswald, 2002). Lego® therapy can be described as one of the PMIs- a child-led intervention, where the facilitator does not give direct instruction unless it is necessary. Moreover, there are only three children and an adult in the therapy group, which differs from the number of people in the classroom/playground significantly, thus decreasing the possibility of generalisation of skills into the more fluid context of classroom/playground.

In contrast, qualitative results illustrate some participants with ASC showed improvement in other small group settings, such as observed improvements in their concentration. Although the positive effects of Lego® therapy appeared not

to generalise in classroom/playground setting, the qualitative results indicated that some participants with ASC transferred some of the learnt skills into other settings which have similar features to Lego® therapy group.

Furthermore, according to the TAs' descriptions, some positive changes were observed outside the therapy sessions; relating to concentration and higher engagement with work. These elements are not measured by the SRS-2, which highlights a possible limitation of the design and will be discussed further in a later section.

Lastly, one of the selected cases- Karen, appeared to have positive changes after attending the 8-week Lego® therapy. Her SRS-2 scores in social awareness, restricted interests and repetitive behaviours appeared to improve, although in the overall SRS-2 she did not show statistically significant changes. Furthermore, she was observed by school staff to have become more confident outside the sessions. This suggests that she may have benefited from the skill development within the intervention and showed potential positive changes in her social impairment features.

5.3.3. RQ 2.1: Does participation of a TD child in the Lego® therapy group impact upon the social interaction in the playground of children with ASC?

Statistical analysis showed that participation of a TD child in the Lego® therapy group did not have a statistically significant impact on the frequency and levels of social interaction of children with ASC. As far as the researcher is aware, this is

the first study to include a TD peer in the Lego® therapy group in a school setting. PMI has been criticised in relation to its limited generalisability because research has shown that the target child only interacts with those TD children in the intervention but not others (Barry et al., 2003). In the current study, the same group of children worked together every week for 8 weeks and opportunities for working with other TD children did not take place. This may also limit the generalisation of learnt skills of the participants with ASC and the overall efficacy of the intervention.

The ultimate generalisation is to have children with ASC interacting with different TD children in different contexts (Gillis & Butler, 2007; Rogers, 2000). If we break down this ultimate goal into multiple steps, one of the medium goals should be that participants with ASC would be interacting with TD participants in other contexts. Subtheme 2.2 revealed that TAs observed participants with ASC interacting with TD participants in the playground more frequently. This indicated that there was a potential increase in interaction between the ASC and TD participants in other contexts, although this was not shown in the POPE data as statistically significant. Although this subtheme did not illustrate that the target children interacted with other TD children in the playground, interaction with the TD participant in other contexts should be encouraged and embraced. It suggests that some of the participants with ASC are one step closer to the ultimate goal and that participation in the group may enable the ASC group to begin to develop interaction skills that may develop further over a longer timescale.

A further qualitative finding was consistent with Ochs et al.'s (2001), peer-mediated intervention study, which showed that TD participants changed their attitude towards children with ASC after the intervention, with TD participants showing more empathy and tolerance towards children with ASC (Jones, 2007). In subtheme 2.2, one of the TAs described a TD participant as showing more patience in the sessions and trying to protect the participant with ASC in the playground.

DiSalvo and Oswald (2002) applied Bandura's (1997; cited in DiSalvo & Oswald, 2002) social cognitive theory to explain these positive changes in TD participants; they suggested that the TD participants' expectations of children with ASC are altered through the PMI, leading to an increased effort to interact with ASC participants. This finding has important implications for increasing social interaction for children with ASC. The REPIM shows that children with ASC are more likely to engage in negative peer interactions because of their poor social skills and high frequency of negative peer interactions may draw the child away from social interaction (Humphrey & Symes, 2011). It follows that social withdrawal serves as a barrier to the development of social skills by significantly reducing the child's opportunity and motivation to interact with others and thereby acquire effective interpersonal skills. This vicious cycle then continues to affect the child's social life. In the scenario mentioned above, this vicious cycle may potentially be interrupted by TD peers (the exogenous factor in the REPIM) providing positive social interaction experiences for children with ASC, which, if

continued, could serve as a potential motivating factor for children with ASC to interact.

Subtheme 3A revealed that providing language support was observed in TD children during the sessions. It could be argued that providing language support may not be related to social interaction. However, Kamps, Leonard, Potucek and Garrison-Harrell (1995) looked at TD peers pairing and supporting students with ASC in relation to language comprehension. They found that social interactions for students with ASC increased both during the intervention and post-intervention period. As illustrated in the example above, Brad, the TD child, was reported to have provided language support in the session. Brad was also observed to interact with one of the other two participants with ASC in the playground in theme 3B. These subtle changes were not found in the POPE but were reported by the TAs and therefore future research could investigate this further.

5.3.4. RQ2.2 Does participation of a *TD* child in the Lego® therapy group impact upon the features of social impairment of children with ASC when rated by their class teacher?

Outcome data on the SRS-2 did not show any statistically significant difference between the three groups after 8-week of Lego® therapy intervention. These results indicated that participation of a TD child in the group did not make any statistically significant differences in features of social impairment of participants with ASC as rated by their teachers. Typical PMIs involving TD peers usually involve the systematic teaching of ways of engaging children with ASC and

raising interaction opportunities within natural environments, thus supporting children with ASC to develop social skills (Mason et al., 2014). In the current study, TD participants were recruited by the school SENCos. Although these children were asked to participate in the Lego® therapy group with children with ASC, they did not receive any additional systematic training on ways to interact with children with ASC. The structural setting of Lego® therapy alone may not be enough to optimise the benefit of including a TD child in the group. Furthermore, Lego® therapy is a play-based intervention with minimal support from the facilitator, TD participants may potentially have a bigger impact if they received training sessions prior to the Lego® therapy sessions, including specific instruction in strategies to encourage and support social behaviour.

5.3.5. RQ 3: What are the views of TAs delivering Lego® therapy groups about the implementation and effectiveness of Lego® therapy?

In order to answer RQ3, data was collected through a semi-structured interview with TAs during the post-intervention period. Questions were asked about factors that the TAs found to be either *supportive* or *barriers* to the implementation of Lego® therapy, and also their perception of the effectiveness of the intervention in relation to the participants.

Effectiveness of Lego® therapy

TA interviews indicated that overall, TAs were positive about the intervention. They reported that children selected for the Lego® therapy benefited in social, emotional and other respects, such as concentration. In theme 1, there were five positive changes in total which TAs noticed in the participants with ASC. In

relation to all children, every TA outlined social interaction skills such as taking turns listening, talking and sharing as having generally improved within the sessions. They highlighted in subtheme 1C that improvement in the ability of the children with ASC to manage frustration, speak up and display more patience as the primary skills developed within the sessions. TAs also noticed improvements in children's ability to use language within the groups. Development of friendships between the participants was also observed. Some participants with ASC were also observed to have made positive changes outside the sessions, including better concentration in small group settings and increased confidence.

Qualitative findings revealed that most of the changes were related to positive interaction within the Lego® therapy sessions, while positive changes outside the sessions were not related to social interaction, but related to broader benefits, such as increased concentration and self-confidence. Although quantitative data did not reveal any significant changes, these findings from TA interviews indicate that Lego® therapy in this study had a positive impact on the children with ASC within the sessions and potentially outside the session. Further investigation is needed to confirm whether it has an impact in other contexts.

Another dimension where TAs reported positive outcomes related to the emotional support observed between group members. According to the Social Pedagogic Research into Grouping project (SPRinG; Blatchford, Kutnick, Baines and Galton, 2003), emotional support within the group served as a maintenance element for effective group work. The researchers illustrated that the promotion of socio-emotional qualities can lead to increased co-regulation of participation.

With regards to all the children selected, TAs noticed high levels of enjoyment amongst the participants. Previous studies have illustrated that children with ASC are motivated to participate in Lego® therapy (Brett, 2013; LeGoff, 2004; Owens et al., 2008). A similar pattern of findings was apparent in the current study as the TAs heard children speak enthusiastically about Lego®. Lego® is a highly predictable and systematic toy and some literature would suggest that children with ASC have the tendency to be drawn to structured/systematic tasks (Baron-Cohen, 2009). Baron-Cohen (2009) showed that children with ASC have the tendency to look for systems or patterns and display focused processing. Lawson, Baron-Cohen and Wheelwright (2004) illustrated that children with ASC perform better at tasks requiring systemising than tasks requiring empathising skills. Koegel et al. (2013) emphasised the importance of incorporating the interests of children with ASC as one of the keys features for effective social intervention and the use of Lego® as a medium to motivate the children with ASC appeared to be effective in this study.

TAs also revealed that they enjoyed running the intervention and would like to continue in the future. It has been documented that teacher's enjoyment in the classroom is highly related to student's engagement and performance (Martin, 2006), which has also been shown to enhance social, cognitive, and language development. Thus, TAs' enjoyment of implementing Lego® therapy, emotional support between group members and high level of enjoyment of the participants appeared to serve as maintenance elements for effective group work within Lego® therapy sessions.

Barriers for participants with ASC to access the intervention

Language difficulties were identified as one of the factors hindering participants from accessing the intervention. Some participants with ASC were observed to experience difficulties in understanding as well as providing instructions in the sessions. Research shows that children with ASC are very likely to have difficulties with their expressive and receptive language skills (Norbury & Nation, 2011). Within Lego® therapy, the role of the engineer in particular, requires a range of vocabulary in order to describe the Lego® model, such as prepositions and different vocabulary to describe the various pieces of Lego®, where a participant had difficulties with language, the communication between members of the group could have been adversely affected. Blatchford et al. (2003) state that communication is a fundamental element in effective group work and children without appropriate language skills are less likely to interact with others. LeGoff (2004) stated that language proficiency may affect how children with ASC respond to Lego® therapy, and although the effect was not significant in his 2004 study, he noted that the potential negative influence should be taken into account. One of the selected cases, Simon, displayed language difficulties within the sessions. The TA described him as well-behaved and quiet but continuously struggling with understanding and using language. Language difficulties may be related to subtheme 3C: “frustration”. Some participants with ASC showed frustration during the sessions which could have been caused by a number of issues, such as language difficulties, anxiety or external factors. Children with ASC are characterised by language and social difficulties and there is a growing consensus that their ability to regulate emotions is another significant challenge

for them (Jahromi, Meek & Ober-Reynolds, 2012). Jahromi et al. (2012) compared the ability to manage frustration between TD children and children with ASC, showing that children with ASC displayed a higher intensity of frustration and used significantly more avoidance and venting strategies. Furthermore, social support strategies for regulating frustration such as, expressing the feeling verbally was ineffective for children with ASC. This is exemplified by Alex whose high level of frustration and the range of difficulties he experienced led to a less positive Lego® therapy experience. Alex's emotional stability was also affected by some external events before the Lego® therapy session, leading to frustration during the sessions. Frustration caused by the Lego® therapy process or external factors may have affected Alex's engagement in the session. According to Blatchford et al. (2003), children must establish positive relationships between group members in order to form an effective group. In addition, Blatchford et al. (2003) reported that sensitivity and trust within the group are important elements within a group work environment, which will affect the interactions and achievement between the group members. For example, Alex, due to his emotional difficulties, had difficulty forming positive relationships with the other two participants. The overall effectiveness of Alex's group was questionable due to his emotional regulation barriers. Subtheme 1C revealed that some children with ASC became emotionally more stable throughout the intervention, suggesting that some children were able to adapt and learn. However, other children with ASC in the study, for example, Alex, showed persistent difficulties with emotional regulation. As four TAs reported that "frustration" was one of the

challenges in their sessions, this may be another factor that may impede the overall effectiveness of Lego® therapy.

A further barrier was the emergent subtheme of ‘unwillingness to switch role’. Lego® therapy requires participants to switch role every week so that they have the chance to practise different roles. TAs reported that some children with ASC did not feel comfortable switching roles in this manner. Insistence on sameness and inflexible adherence to routines are features of children with ASC. Researchers have suggested that ED in people with ASC leads to their inflexibility behaviours (Louise, Muldoon, Hasan, O’Brien, & Stewart, 2008), particularly during stressful situations. Lego® therapy can be a stressful situation for some children with ASC. As mentioned previously, some children with ASC may not have sufficient language to play the “engineer” role, causing anxiety and leading to a possible refusal to switch role. However, subtheme 1C showed that participants with ASC became better at regulating their emotions on switching their role. The impact of the unwillingness to switch role in this study could not be measured. Blatchford et al. (2003) state that sometimes group work experiences can be very tense and frustrating and that if tension is not resolved, the problem may escalate and further negatively influence the group efficacy.

These three subthemes (Language difficulties, Frustration and Unwillingness to switch role) were reported by at least 3 TAs, which constituted half or more of the experimental groups. The impact of these difficulties upon the Lego® therapy can be significant, a finding which is supported by Blatchford et al. (2003), who noted that these elements typically serve as “blocking” factors in group work.

Practical factors for implementing Lego® therapy in school

Exploring the implementation of Lego® therapy is an important gap in the research literature for Lego® therapy. Research in this area is crucial because any intervention, in order to be successful needs to be feasible and manageable in a real-world setting (Lendrum and Humphrey, 2012). TAs revealed that rooms and resources were crucial for Lego® therapy implementation. Resources were described as an important factor because children needed to build different models nearly every week and new models were seen as a motivator. Similarly, the room arrangement was also important for implementing the Lego® therapy, where consistency and high predictability are important for children with ASC to learn and develop (LeGoff et al. 2014). Securing access to the same environment / room was a crucial factor to enable the children with ASC to access the intervention. Therefore, having the same room arranged was both practically and therapeutically important for children with ASC in Lego® therapy.

Future improvement

TAs commented on two areas that could improve the Lego® therapy implementation. First, they suggested that the number of sessions could be increased, LeGoff and Sherman (2008) completed 12 and 24 weeks study previously in a clinic setting, which showed several significant results. Comparison with previous studies directly is difficult, as the context and duration of the current intervention was different. The shorter duration of the programme in this study could be one of the reasons for insignificant quantitative outcomes. This will be discussed further in the limitation section below.

Secondly, TAs suggested that Lego® therapy should not be restricted to children with ASC only as they thought "other children with different needs may benefit from the intervention as well." Currently there is no research using Lego® therapy with other children with SEN other than ASC. LeGoff et al. (2014) suggested that Lego® therapy may also be helpful for children with other social communication needs, social phobia and other anxiety conditions. Based on the Lego® therapy structure, it appears that children with social, language and behavioural needs could potentially benefit from the intervention. Further research could investigate the effectiveness of applying Lego® therapy with children experiencing a range of other SEN needs.

Findings from the present study revealed specific school factors which can both positively and negatively affect the implementation process. LeGoff (2004), LeGoff and Sherman (2008) and Owen et al.'s (2007) research was clinic based and thus the current school implementation data are valuable for schools and other professional as references. In addition, since Lego® therapy is becoming more popular in mainstream schools, understanding the feasibility of this intervention is crucial.

5.4. Intervention Fidelity:

Overall intervention fidelity was recognised to be good as each item from the session checklist did not show any statistically significant difference. In addition, attendance rate of both groups was 100%. However, programme fidelity between groups showed statistically significant differences suggesting that the consistency of Lego® therapy implementation might have differed across the six

groups. Insufficient intervention fidelity may diminish the outcomes of the intervention significantly (Belline et al., 2007). The inconsistency between the six groups could have been caused by a number of factors: firstly, it could have been due to differences in TAs' experience of working with children with ASC or running social interventions. Fidelity checklist items 1 – 6 referred to the basic structure of the Lego® therapy, which each group delivered at least 80% in their 8 sessions. Later items, such as item 14 (TA provides opportunity for pupils to problem solve), required scaffolding and a higher level of prompting skills, some groups delivered 100%, while some delivered 63%.

Moreover, the percentage of delivery of item 13 (TA directs the social problem to the whole group) varied between 88% and 63%. This item required TAs to refer the social problems to the group to resolve and, as has been previously shown that TAs are less likely to promote active participation and have the tendency to solve the problem for the children (Webster et al., 2010). Overall, this indicates some TAs showed better teaching skills than others. Webster et al. (2010) state that TAs' interaction pattern with pupils with SEN often lack of quality, foster dependency and passivity. This may suggest that further training and more regular support / modelling at frequent intervals during the intervention for the TA should be provided in order to maintain the quality of the intervention.

Secondly, as illustrated by the case studies (Simon and Alex), some target children showed persistent difficulties, for example, significant language needs and / or frustration. These factors may have impacted on how TAs implemented the intervention as some of the participants with ASC may have required more

intensive support from the TAs. Item 8 (TA minimises direct support) on the fidelity checklist was one of the items which showed a large variation across six groups. Since some children with ASC appeared to have a range of difficulties, direct support from some of the TAs was difficult to minimise and may therefore have been a factor associated with the inconsistencies of fidelity observed between groups.

5.5. Summary of results and contributions of the study:

Quantitative findings indicated that the Lego® therapy intervention did not show statistically significant changes in the POPE and SRS-2 between the three groups after an 8-week intervention. In addition, the quantitative findings also indicated that the participation of TD children in the group did not result in significant changes between the three groups in the measures of the POPE and SRS-2 of participants with ASC.

Qualitative findings indicated that the Lego® therapy programme may have had an impact on several aspects, such as positive changes in social communication, language and emotional regulation within the sessions, friendship development and some potential generalisation outside therapy sessions. TAs in the mixed group noticed the benefit of including TD participants in the group, such as provision of language support for other children with ASC within the sessions. TAs also observed some interactions between the TD participants and participants with ASC in the playground.

TAs reported that difficulties in language, emotional regulation and willingness to switch role served as barriers for the participants with ASC to engage completely in the intervention. In addition to limitation in the design, these barriers might also have hindered the effectiveness of Lego® therapy.

Lastly, TAs suggested several elements which are important for implementing Lego® therapy, such as room and resources. They also suggested a number of ideas for future improvement for Lego® therapy.

5.5.1. Strengths and contributions of the study:

The current study has a number of distinctive strengths and contributes positively to the existing knowledge base. In the current educational context of services moving towards evidence-based interventions (DfE, 2014), the effectiveness and appropriateness of using a clinic based intervention in an educational setting needs to be examined. This study is one of the first to look at the effectiveness of Lego® therapy delivered to groups of children with ASC in a school context. Information collected in the study can be shared with schools and professionals who want to deliver Lego® therapy to children with ASC, enabling them to consider implementation in their specific contexts.

As one of the first studies to include TD peers in the intervention group, this study has provided some unique qualitative data on how participants with ASC may potentially benefit from the inclusion of TD participants in the intervention group. This led to further understanding on how TD participants may potentially support

and participate in the intervention, which add a further dimension to existing research.

This was first study to use a mixed methods approach to evaluate Lego® therapy, the current evidence-base of using Lego® therapy in educational contexts and providing important insights into the process of running Lego® therapy in school. It also highlights the potential barriers that children face during the sessions. Only one piece of research explored the qualitative side of Lego® therapy (Brett, 2013), and semi-structured interview data from TAs in this study provided further insights into the implementation of Lego® therapy. Moreover, this study highlighted the importance of consistency in intervention fidelity, which is a crucial element, not just for Lego® therapy but all interventions.

The use of a case study methodology was a strength of this study. The heterogeneous nature of children with ASC may cause problems in this study as individual differences were likely to be magnified in this small sample size, which in turn, may have affected the overall results. Therefore, a case study methodology was incorporated in addition to the quasi experiments. In addition, case studies were also used to weave the quantitative and qualitative data together in this study and it helped the researcher to identify patterns of similarities and differences between the selected cases. Karen and Simon were chosen as they appeared to respond to Lego® therapy positively. Their quantitative and qualitative data both suggested that Lego® therapy was an effective social intervention for them. On the other hand, Alex and Simon's quantitative data revealed that they did not benefit from Lego® therapy, and most

importantly, their qualitative data suggested that their difficulties in language and emotional control served as barriers to them to access Lego® therapy. Quantitative data on the whole showed that Lego® therapy was not an effective intervention; however, it did not on its own provide any explanation. Case studies helped the researcher to explain why and how Lego® therapy was and wasn't effective to some participants through considering the heterogeneous nature of children with ASC. Case studies also offered some potential reasons to explain the ineffectiveness of the intervention shown in the overall quantitative data.

5.6. Possible explanations for the discrepancy:

A discrepancy exists between the quantitative and qualitative results reported above. There are a number of potential explanations which could account for the discrepancy. First of all, individuals with ASC are described as a heterogeneous group, in that they have unique characteristics (Happé et al., 2006). It could be suggested that these individual differences may have influenced the way in which the children responded to Lego® therapy.

Another possible explanation could be the duration of the intervention in the study itself. Lego® therapy in the current study was only implemented for 8 weeks. Bellini et al. (2007) suggested that intervention should consider 30 hours or more with high intensity, thus the shorter length of the current intervention may limit the potential positive effect. In addition to this, Watkins et al. (2015) suggested that the consideration of intervention characteristics themselves is important when choosing the most appropriate intervention for children with ASC. Some children with ASC may lack the skills or ability to engage appropriately and/or some may

demonstrate a lack of interest, motivation or confidence. It is suggested that naturalistic intervention may be more appropriate for this latter group (children who are lacking in interest, motivation or confidence), e.g. Karen. Whilst for children who lack skills (e.g. Simon,) direct instruction of social interaction is said to be more appropriate (Watkins et al., 2015). The characteristics of the participants, context and the length of the intervention may potentially affect skill establishment and generalisation and may have led to the discrepancy between quantitative and qualitative results.

The intervention fidelity results also revealed some valuable information. Programme fidelity between the groups was not consistent. Therefore, the effectiveness of Lego® therapy may not be the same across the groups. Due to the small sample size, the variation between the groups could become significant, thus potentially diminishing the overall effectiveness of the intervention.

Lastly, the complexity of social interaction is demonstrated by Taubman et al. (2011), where Lego® therapy seems to be focusing on the basic and intermediate levels of social interaction skills. Having the structured roles in Lego® therapy i.e. engineer, builder and supplier, it could be argued that the types of interactions between the roles can be static requiring response to instructions only. A true social interaction is described by Kaczmarek (2002) and is one where there is initiation and response interchanges between parties. This indicates that there is possibly room for improvement in the design of Lego® therapy so that it better provides opportunities for this bi-directional interchange in social interaction rather than a simple response to instruction. This might also explain the

discrepancy in this study, because participants with ASC learned to listen and respond in the structured setting and their responses were shaped by the distinct role (e.g. engineer, builder or supplier) they were given. Although there were "free style" periods given for the participants to generalise their learnt skills, it appeared that there were limited opportunities for the participants to learn how to actively initiate interaction.

Overall, Lego® therapy did not show significant effect on the frequency and levels of social interaction, and social impairment features of children with ASC, although some of the qualitative findings hint that some children may potentially benefit from the intervention. Careful consideration needs to be given to the characteristics of the children with ASC in order to select the right intervention for the right child.

5.7. Limitations and implications of the present study for future research

The current research attempted to improve social interaction amongst Key Stage 2 students with ASC and their peers by using an 8-week Lego® therapy intervention. It is important to address the limitations of the current study so that an overall understanding of the results reported within context, their applications and implications for future research can be established.

Small sample size is one of the limitations of this study. 19 participants with ASC from five schools limits the generalisation of the research findings to the wider ASC population. Since children with ASC are a heterogeneous population

findings of the present study may not apply to all children with ASC (Happé et al, 2006). Some children with ASC may or may not respond to the intervention and therefore individual factors need to be considered. Lack of randomisation in sampling and allocation to groups is a further limitation. These factors are threats to the internal and external validity of the quasi-experiment, and impact on its interpretation. This study would have been strengthened by including a wait-list control group who would have received Lego® therapy after the study period. This was not possible because of the time constraints on the research presented here. In addition, follow up studies could be conducted in order to investigate whether there is any delayed benefit and maintenance of learnt skills.

An additional limitation of this research relates to the measurements utilised to explore social interaction, which were relatively broad. A more sensitive tool used over a longer period of time might have discovered more about the links between the intervention and social interaction. Whilst the SRS-2 is a standardised tool, over reliance on this as the sole report from class teachers in this study placed limitations on the study's findings. LeGoff (2004), LeGoff and Sherman (2008) and Owen et al. (2008) measured the duration of the social interaction in their study. Future studies could attempt to replicate their procedure, by including a measure of duration of interaction. This research explored social interaction (frequency and levels of social interaction). A number of other factors could be explored in order to extend understanding of the impact of Lego® therapy on children with ASC, such as emotional regulation. TAs observed other positive

changes in participants with ASC, such as concentration, task engagement and friendship development. These could also be explored in future studies.

This research study design attempted to reduce the influence of confounding variables, by recruiting participants who did not receive any social skills interventions during the research period for example and controlling for children's cognitive profile. Despite this, some influential factors alongside the intervention are inevitable, such as the Hawthorne effect. The Hawthorne effect refers to the tendency for participants to change their behaviour in response to being studied, which may have had an impact on findings (Chamberlain et al., 2007). Research has shown that children with ASC are unlikely to display the Hawthorne effect as their deficits in ToM make it less likely that there will be an adjustment in their behaviour in response to being studied (Sodiam & Frith, 1993). In this this study no preventative procedure was undertaken and therefore the potential impact of the Hawthorne effect cannot be ruled out.

Programme fidelity was recorded in this study, and the researcher observed the fifth session of all the experimental groups. The intervention fidelity results show that there were some inconsistencies between the groups. Perhaps longer or multiple training sessions could be provided for the TAs in order to maintain consistency.

Another potential limitation was the involvement of TD participants. Specific training was not provided to TD participants prior to the interventions. In some PMI research studies, trained TD peers were crucial in order to ensure the

effectiveness of the intervention (Matson, Matson & Rivet, 2007; Kasari et al., 2011). Future research could usefully explore the potential benefits of providing training sessions for the TD children, specific ways to initiate introduction and promote social interaction for example.

The views of the children themselves were not sought as part of the research and therefore children's reflections on their experience of the Lego® therapy were not reflected within the research and neither were those of their parents. The original research design included the collection of parental views, however, it was not possible to explore parental perspectives. The decision not to include children's views was due to time constraint and also to safeguard the children from the stress of being observed on four different occasions and to protect the observation data's validity. Children and parents' views however would have strengthened the research findings and ensured that the Lego® therapy was relevant for them. It could also have included an exploration of the children's perceptions of the intervention and factors that particularly motivated them (Brett, 2013). In particular, their views on the impact and the effectiveness of the intervention would be highly valuable, such as potential changes in the home setting after participating Lego® therapy intervention.

A final limitation of the current study relates to the semi-structured interview with the TAs. TAs' perceptions may have been impacted upon by their view of the research intentions (i.e. evaluation of the effectiveness of Lego® therapy) and a potential wish to provide positive outcomes for the participants, demonstrating the effectiveness of the Lego® therapy intervention.

5.8. Implications and relevance to Professional EP Practice

The Office of National Statistics (2008) estimates that there are over 32,500 students with ASC attending mainstream schools. EPs are likely to be required to implement effective interventions and provide strategic support for this group. EPs typically provide recommendations on a range of different interventions for schools to support children with different needs and will often provide training for staff so they can implement the interventions appropriately in school. Several implications have arisen from the current study, and these should be considered when implementing Lego® therapy in the future.

Although this study did not show any statistically significant changes on a group level, some children with ASC were observed to benefit from the intervention. This highlights that Lego® therapy may not be suitable for all children with ASC and close monitoring of the appropriateness of the intervention is required. For example some children may not have sufficient language ability to benefit from the intervention. EPs are well placed to work collaboratively with SLTs and school staff / parent carers in deciding whether the child is likely to benefit from the intervention or whether additional training should be provided before participating in a specific intervention. Moreover, EPs are equipped to use consultation skills to gather information about the child, thereby gathering information that can support the identification of the appropriateness of using Lego® therapy. They are also well placed to work at a more systemic level to ensure that schools who wish to implement the Lego® therapy consider the various factors that may impede or support the intervention's success.

It should be noted that access to a suitable room and resources are also crucial factors in the implementation process of Lego® therapy. As mentioned above, consistency in relation to room/environment is important for some children with ASC, who may not cope well with environmental changes. EPs can emphasise the importance of environmental factors to ensure children with ASC are motivated to engage with Lego® therapy.

The length of the intervention should also be considered. While this study did not result in any statistically significant results, other studies (LeGoff, 2004; LeGoff and Sherman, 2006, Owen et al., 2008) have illustrated several positive outcomes of Lego® therapy. However, it is difficult to compare this study directly with previous studies as their findings were clinic based and used different outcome measures. According to Bellini et al.'s (2007) review of social interventions, they proposed that intervention should be implemented more intensely and frequently. Therefore, EPs and schools should play a role in monitoring progress and also play a role in establishing the length of the intervention.

Given that children with ASC are different from one another, close monitoring needs to be carried out for each child. EPs and school staff also need to monitor the programme fidelity as the results show that some schools did not execute the programme fidelity as well as others. EPs can provide this support and implement measures with schools in order to maintain the quality of the evidence-based intervention and thereby optimising effectiveness.

With the current economic climate, group interventions may be selected in preference to individual interventions, due to enhanced cost effectiveness. And in the light of recent SEND reforms and the need for effective evidence based interventions at a school level, programmes such as of Lego® therapy have increased in popularity (DfE, 2014). However selection of participants and implementation may not always be robust. As illustrated above, individuals with ASC may experience a range of difficulties when working in groups, such as difficulties with language and communication or emotional regulation. EPs are equipped to provide insight into group dynamics and factors that could improve the efficacy of group work, such as following the guidelines from the SPRinG project (Blatchford et al., 2003). In terms of Lego® therapy, not every child with ASC is suitable for this intervention without extra training or pre-teaching, due to the potential language and emotional demands placed on the children within the intervention. EPs are well-placed to advise schools and support the delivery or provide additional training for the children prior to the intervention in order to maximise effectiveness.

5.9. Conclusion:

The researcher believes that this study meets its aims in providing an investigation into the effectiveness of Lego® therapy to improve social interaction and other social impairment features for children with ASC in school. In addition to this the study examined the effectiveness of the participation of TD peers in the Lego® therapy group. No significant change was found in measures of social interaction and features of social impairment on a group level. The lack of

significant intervention effect is likely to be caused by the small sample size, inconsistency of programme implementation between groups, heterogeneous population of participants with ASC and the length of the intervention. Case studies revealed that there were individual factors that potentially created barriers for participants with ASC in accessing Lego® therapy, therefore further research is needed to explore the overall effectiveness.

Qualitative findings provided evidence for the effectiveness and implementation process of the intervention and several key themes were revealed: positive changes were reported within the sessions; the involvement of TD participants appeared to be beneficial for participants with ASC and TD participants themselves; participants with ASC had a number of issues that inhibited full engagement within the sessions such as language difficulties, frustration and unwillingness to switch role; facilitating factors within the Lego® therapy sessions which support the implementation; and finally practical elements for running Lego® therapy in school.

This thesis builds upon the existing Lego® therapy literature by evaluating its effectiveness within the school context. Previous studies were largely clinic based (LeGoff, 2004; Owen et al., 2008) and only two studies examined educational contexts (Andras, 2010; Brett 2013). These research results provide an extension to the existing intervention literature by investigating its effectiveness in school contexts, the participation of TD peers in the group and the implementation process of Lego® therapy in school. Lego® therapy is being used by SLTs and schools as a social skills intervention for children with ASC

and findings in this study are valuable for schools and professionals to consider when working in this field.

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7. Appendices:

Appendix 1 Current literature of Lego® therapy used with children with ASC

Study	Design	Participants	Outcome measures*	Lego® therapy Duration and context	Results
LeGoff (2004)	Repeated measures/waiting list design	Total 47; Age 6 – 16 12-week Group (26) 24-week Group (21)	SISC DSI GAR-SI	12 weeks and 24 weeks (90mins) ; Clinic Based	1) DSI increased 74% (12-week group) & 175% (24-weekgroup) (p<.01) 2) SISC increased 69% (12-week group) & 8 (24-week group) (p<.01) 3) GAR-SI improved -1.38(12-week group) & -2.81 (24-week group) (p<.01)
LeGoff and Sherman (2006)	Pre- and post-treatment series design	60; mean age 9.3	GAR-SI VABS-SD	36 months (90mins) ; Clinic Based	1) Significant Positive effect on adaptive behaviour (GAR-SI)

					(p<.001) 2) Reduction in socially inappropriate behaviours of all participants (VAB-SD) (p<.001)
Owen el al. (2008)	Randomized block design; Compared Lego therapy and Social Use of Language Programme(SULP)	28; Age 6-11 Lego® group (14) SULP group (14)	SISC DSI GAR-SI VAB-SD VAB-CD VAB-MD Parent and children satisfaction	18 weeks (60mins); Clinic Based	1) DIS increased 1.8 sec (p<.05) 2) Improvement in VABS-Maladaptive behavior (p<.05) 3) All participants in Lego® group rated 10/10 satisfaction
Andras (2012)	Small scale within groups design	8; Age 8-11	Frequency of initiation of interaction	10 weeks (45mins); School Based	1) The mean of initiation of interaction showed increasing trend
Brett (2013)	1) Within-subjects quasi-experimental design; 2) Semi-structured	1) 14; Age7-11 2) 13; Age 7- 11	SISC DSI VAB-SD VAB-CD	8 Weeks (45mins); School Based	Study 1: 1)Improvement in Adaptive socialization (p<.05)

	interview with participants with ASC				2) Improvement in Play ($p<.05$) Study 2: 1) Aspects of Lego therapy that are enjoyable. 2) Aspects of Lego therapy that make the intervention less enjoyable 3) Children's views on extrinsic rewards.
Huskens et al. (2014)	Multiple baseline Case study; Using Robot as facilitator	3; Age (5, 9, 10)	Frequency of collaborative behaviour	5 weeks (30mins); Lab based	1) No Statistically significant changes 2) Parent reported positive changes at home

* SISC (Self-initiated social contact); Duration of social interactions (DSI); Gilliam Autism Rating Scale Social Interaction Subscale (GAR-SI; Gilliam, 1995); Vineland Adaptive Behaviour Scale-Socialisation Domain (VAB-SD); Vineland Adaptive Behaviour Scale-Communication Domain (VAB-CD); Vineland Adaptive Behaviour Scale-Maladaptive Domain (VAB-MD); Initiation of interaction (verbal, proximity, touch and copying); Collaborative Behaviour (Interaction initiations, responses, play together)

Appendix 2 Lego® Therapy Training and Manual (Brett 2013; LeGoff et al., 2014; Owen et al., 2008) (1/6)

LEGO THERAPY

Sam Cheng
Trainee Educational Psychologist

What is Lego therapy?

- It has been proven to be an effective way for children with ASC to improve their social interaction and communication skills.
  - E.g. Turn taking
  - Sharing
  - Verbal non-verbal communication
  - Problem-solving
- Child-led and peer-based play utilizing natural interest in collaborative play
- Children work together to build Lego Model

Why?

- Lego is a systematic toy that children with ASC are attracted to.
- Collaborative activity promotes social interaction and social development
- Natural play environment promotes generalisation.

Structure

- In total 45 minutes:
- 30 mins structured collaborative Lego building
- 15 mins free style play
- 3 distinct role: Engineer, Builder and Supplier

Engineer

- Engineer:
- Looks at the instructions guide/plan
- Lets the supplier know what Lego pieces the builder needs
  - E.g. Number of bricks required?
  - What type of brick? What shape?
  - What colour?
  - What size?
- Tells the builder how to put the pieces together

Supplier

- Listens to the architect to find out what pieces the builder needs
- Gives the correct pieces to the builder
- Ask questions Engineer to clarify the Lego
  - E.g. Did you say 3 red bricks?
  - How many studs?

Builder

- Gets the Lego pieces from the supplier
- Listens to the engineer to find out how to put the pieces together
- Clarify the instruction with Engineer
  - E.g. Did you say put the blue brick on the red brick?

Facilitator

- Watch the group
- Help others in their roles
- Make sure they are following their role
- Help others to listen, focus and take turns
- Mediate disagreement
- Keep everyone on task
- Prompt the children to create solution instead of direct support
- Summarise in each session, highlight good social skills and team work.
- Follow the programme checklist and complete every session.

Session structure

- Everyone greets each other
- Recap Rule and discuss Lego model
- Assign Role and have their names on the role card
- 30minutes collaborative building
- 15 free play
- Children tidy up
- Facilitator to summarise the session and highlight the good behaviours, e.g. good sharing, social interaction, problem solving…etc

Role Play

- Let's try to do Lego therapy ourselves!
- Q and A?
- THANKS and ENJOY!

References

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- LeGoff, D. B., & Sherman, M. (2006). Long-term outcome of social skills intervention based on interactive LEGO play. *Autism*, 10(4), 317-329.
- Owens, G, Granader, Y, Humphrey, A & Baron- Cohen, S (2008) LEGO Therapy and the Social Use of Language Programme: An Evaluation of Two Social Skills interventions for Children with High Functioning Autism and Asperger Syndrome *Journal of Autism Developmental Disorders* 38, 1944–1957.

Lego® therapy Manual
General Structure:

3 children in the same group and same room each week for 8 weeks. 45 mins per session: 30 mins structured Lego building and 15 mins 'freestyle' building in group.

Session structure

1. Everyone greets each other.

2. Facilitator presents the Lego sets and discusses the model with all children.

3. The Lego rules are presented and recaped with everyone.

Rules:
It is important for children to review the rules every week. A print copy should be presented so that they can refer to the rules.

If you break it, you have to fix it
If you can't fix it, ask for help
If someone else is using it, don't take it, ask first
No yelling. Use indoor voices
No teasing, name-calling or bullying
No hitting or wrestling – keep hands and feet to yourself
Clean up- put things back where they belong.

4. Children to be given their roles and with their names written on the role card.

Role responsibility is recapped. Role cards should be placed next to the rules so that they have clear idea of their role:

Roles:

- Engineer - reads instructions
- Supplier- sorts and finds bricks
- Builder - builds the model

In the initial session, facilitator should help children to pick their role. A system of role assignment should be established, facilitator should help the children to build up a system on how to assign roles fairly, such as static rotation or lucky draw.

5. Building with instructions (30mins)

Facilitator should encourage the development of social interaction and communication, such as turn taking, responding, initiating, joint problem solving, sharing, verbal and non-verbal communicating, paying good attention to each other.

Prompting: Facilitator minimizes theirs direct involvement as much as possible to ensure the nature of child-led environment. For example:

Child A: Child B is not sharing the wheels.

Facilitator: Yes, you have to talk to him about that.

Child A: He is not sharing and I really want it for my R2D2.

Facilitator: Sure, what should you do?

Child A: I am not sure.

Facilitator: “Lego Club”, what should Child A do?

In the example above, facilitator tries to direct the question back to the child, and then re-direct the question to the whole group in order to create joint-problem solving opportunity.

Behaviour Management:

In rare circumstances, participant may either refuse to comply with a rule or persis with being inappropriate in during the session. This situation often occurs at the beginning, during transition or at the end of the session. A number of strategies can be used:

A. Refer to the Lego rules
B. Let the child to correct his/her behaviour
C. Refer to the whole group
D. Verbal warning
E. Time-out (it has to be reported to SENCo after the session). The child who causes the problem has to stop all activities, and sit on the side for 3 minutes (longer if require). After 3 minutes, all group members stop all activities and discuss the situation and how to avoid in the future.

6. Freestyle building (15mins)

Children are told to play Lego without the role. Children can decide whether to build something together, separately but with similar theme or completely separated.

7. Children to tidy up

8. Summary/good bye

Facilitator to ask what went well in the session and what did not go well. Positive praises should be given to all members for excellent team working.

Appendix 3 Lego® therapy background information for schools and parents

Lego® Therapy

What is Lego® therapy?

Lego® Therapy is an intervention designed for children with Autism Spectrum Conditions (ASC) to improve their social interaction and communication skills.

How does Lego® therapy work?

There are 3 roles for children to take part, Engineer – gives step by step instructions. His role is to instruct the builder to build the set of Lego®. He also needs to instruct the supplier to give the correct piece of Lego® to the builder. Builder – needs to construct the Lego® set. Supplier – needs to provide the correct piece of Lego® to the builder. Each session lasts for 45 minutes. It includes 30mins of structured Lego® play by completing a set of Lego® together and 15 minutes of freestyle building. During the freestyle period, children are required to design and build an object together. In each session, an adult facilitator is presented to support, prompt and facilitate the session.

Research on Lego® therapy:

LeGoff (2004), LeGoff and Sherman (2006) and Owens, Granader, Humphrey and Baron-Cohen (2008) show that Lego therapy can be an effective means of developing verbal and non-verbal communication, joint attention and task focus, collaborative problem-solving, sharing and turn taking. It has also been shown in leaning and generalisation of social skills and reduction of behavioural concerns.

Lego® Therapy is suitable to deliver in school. It is a cost effect intervention and can be easily implemented. The current research aims to investigate whether social skills, communication and interaction increase in children after taking part Lego® Club in school.

Benefit for Typically Developing Peers to help in intervention for children with ASC (Jones, 2007):

- Research show that Typically Developing Peers' social skills improve after helping in the social intervention.
- They develop greater empathy, sensitivity and tolerance for individual differences.
- They enjoy and value of participating. They feel satisfying and intrinsically rewarding

References:

Jones, V. (2007). `I felt like I did something good' - the impact on mainstream pupils of a peer tutoring programme for children with autism, *British Journal of Special Education*, 34(1), 3-10.

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Initial letter to school

Dear Headmaster/Headmistress and SENCo,

I am a trainee Educational Psychologist undertaking a Doctorate in Professional Educational, Child and Adolescent Psychology at the UCL, Institute of Education, University of London. As part of the doctoral course I am undertaking supervised research, the focus of which is an evaluation of the effectiveness of the LEGO therapy in improving social skills of children diagnosed with autism spectrum.

Lego® therapy is a naturalistic intervention which uses natural play equipment and the flexibility to implement the intervention within the school setting. Previous studies have been suggested that this intervention promotes social interaction and communication skills for children with autism spectrum condition (ASC). This research aims to measure the effectiveness of Lego® therapy on developing social interactions skills in children with ASC within the school setting. Please see attachment for additional information about Lego therapy. If your school is willing participate this study, your school will receive:

1. Lego® therapy training to a number of school staff. The training will last approximately 2 hours.
2. I will support throughout the research period on ways to implement and deliver the sessions. Throughout the supporting process, teaching staff will be advised and supported in a secure environment and also build confidence in running the intervention.
3. Feedback about the results of the research

In order to support my research, several requirements are needed :

- **2-3 children in KS 2 with Asperger syndrome or high functioning ASC.**
- **1 typically developing children in KS 2 to volunteer to help in the Lego® therapy**
- **1 TA to run the Lego® club for 45 minutes each session for 8 weeks from September to December. The intervention can be arranged at any time throughout the day.**
- **A questionnaire needs to be completed by the class teacher of the target children with ASC at 2 time points, September and December.**
- **I will need to observe the target children with ASC during lunch time in the playground between September and December. Parental consent will be sought by the researcher.**
- **At the end of the intervention, I will need to interview the teaching assistant in order to gather more information.**

If you would like to participate or have any question about this project, please contact me by email by 5th September.

Yours sincerely,

Sam Cheng

Trainee Educational Psychologist at xxxxxx Educational Psychology Service.

Doctoral student in Educational, Child and Adolescent Psychology at UCL, Institute of Education, University of London.

Letter and Consent form for parents of children with ASC

Dear Parent,

I am a trainee Educational Psychologist undertaking a Doctorate in Professional Educational, Child and Adolescent Psychology at the UCL, Institute of Education, University of London. As part of the doctoral course I am undertaking supervised research, the focus of which is an evaluation of the effectiveness of the Lego® therapy in improving social skills of children diagnosed with autism spectrum condition (ASC).

Lego® therapy is a naturalistic intervention which uses natural play equipment and the flexibility to implement the intervention within the school setting. Previous studies have been suggested that this intervention promotes social interaction and communication skills for children with autism spectrum condition (ASC). This research aims to measure the effectiveness of Lego® therapy on developing social interactions skills in children with ASC within the school setting. It involves 45mins weekly sessions which will be completed in school, by trained teaching assistant. In order to support the study, I would like to observe the children at school and carry out some assessment activities. I may also ask parents to complete a questionnaire at different stages through the study.

The school has suggested that your child is likely to benefit from Lego® therapy. Participation in the study is voluntary. They may withdraw from the study at any time. I am happy to provide parents with their child's assessment findings and their progress throughout the training programme. When the research is written up, all the data will be anonymised. The study is likely to have positive changes to individual children and also potentially the wider autistic community. I sincerely hope that you will take up this exciting opportunity.

Please complete the permission slip overleaf and return it to your child's school **5th September, 2015.** You are welcome to contact me if you have any enquiries.

Yours sincerely,

Sam Cheng

Trainee Educational Psychologist, UCL, Institute of Education, University of London

Email: XXXXXXXX Contact Number: XXXXXXXXXXXX

Parent Consent Form:

I fully understand the aims and purposes of the research project:

- My child's ,_____ ,participation of this Lego® therapy project is voluntary.
- I am giving consent to my child's participation and I have the right to withdraw their participation at any stage in the research.
- I understand that all the information that is gathered by the researcher will only be used for the purposes of the current intervention evaluation - Lego® therapy.
- All the information that is gathered will be anonymised, treated as strictly confidential and kept securely throughout the whole process.
- All the gathered data will be destroyed a year after the research project.
- If there are any concerns or questions about my child's well-being which is related to their participation in the research I will share my thoughts with the researcher and the school.

(Print name / Signature)

If you have any questions about the Lego® therapy project, please contact:

Sam Cheng (Contact detail: xxxxxxxxxxxxx)

Letter and parent consent form for parents of typically developing children

Dear Parents/Carers,

I am a trainee Educational Psychologist undertaking a Doctorate in Professional Educational, Child and Adolescent Psychology at the UCL, Institute of Education, University of London. As part of the doctoral course I am undertaking supervised research, the focus of which is an evaluation of the effectiveness of the Lego® therapy in improving social skills of children diagnosed with autism spectrum condition (ASC).

We would like to invite your child to **help** in this project. Your child should only join if you or they want to; choosing not to take part **will not** disadvantage you or your child in any way. Please read the following information carefully before you decide whether you would like your child to take part. Please ask if there is anything you would like to know more.

Details of Lego Club:

This project targets to find out whether **typically developing** children (your child) playing Lego® collaboratively with pupils with ASC can improve their social interest and also their skills to work collaboratively with peers.

We would like your child to come along to **45mins sessions 8 times** between September and December. During these sessions, your child will be playing with

Lego® together with two more pupils with high functioning ASC. Teaching assistant will be facilitating the collaborative play in all the sessions.

The Benefits:

There are many potential benefits to participation in this project, for the children taking part and for the school.

In terms of benefiting the participating children, learning to play collaboratively has been shown by previous research to have positive impact upon social skills, self-esteem and academic achievement. It may also potentially enhance the social inclusion of vulnerable of children such as those with Autism.

There are numerous positive impacts for the peers and schools involved in peer-mediated intervention. This project encourages teamwork and teaches students to develop socially acceptable skills for helping their peers (with autism spectrum disorders or not). It also promotes understanding and tolerance of those that are different and may even play a role in reducing bullying.

Research shows that there are potential benefits for typically developing children to participant in this study:

- Greater empathy, sensitivity and tolerance for individual differences,
- Improvement in social skill,
- Enjoyed and valued of participating,
- High level of satisfaction and intrinsically rewarding.

If you are happy for your child to participate in this study, please sign and return the consent form attached and return to school by Xth Sepmtember, 2015. Even

if you consent to join now but would like to withdraw in later stage, you can withdraw from the study any time without giving a reason.

If you require any further information on the study, please feel free to contact me.

Thank you in anticipation

Yours sincerely,

Sam Cheng

Trainee Educaitonal Psychologist at xxxxxx Educational Psychology Service.

Doctoral student in Educational, Child and Adolescent Psychology at UCL, Institute of Education, University of London.

Parent Consent Form:

I fully understand the aims and purposes of the research project:

- My child will be helping this research project voluntarily.
- I am giving consent to my child's participation and I have the right to withdraw their participation at any stage in the research.
- I understand that all the information that is gathered by the researcher will only be used for the purposes of the current project - Lego® Club.
- All the information that is gathered will be anonymised, treated as strictly confidential and kept securely throughout the whole process.
- All the gathered data will be destroyed a year after the research project.
- If there are any concerns or questions about my child's well-being which is related to their participation in the research I will share my thoughts with the researcher and the school.

(Printed name / Signature)

If you have any questions about the Lego® therapy project, please contact:

Sam Cheng (email: xxxxxxxxxxx)

Appendix 4 The Playground Observation of Peer Engagement (POPE; Kasari, Rotheram-Fuller, & Locke, 2010)

Child's ID: Date:

School: Period of Observation: 1 / 2 / 3 / 4

Int	State	Target Child initiations	Target Child Responses	Comment
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

State: S=Solitary, X = Proximity; O = Onlooker, PA = Parallel Aware, PP=Parallel

Play G=Games with Rule, JE= Joint Engage

Social interactions on the playground are coded using one minute intervals. Social interaction states are coded along with the presence or absence of discrete interactive behaviors during each coding interval. The first 40 seconds of each minute are designated for observation and coding of discrete behaviors. The last 20 seconds of the interval are designated for coding interactive state. A stopwatch beep indicates the end of this observation period.

Social interaction State	Description
Solitary play	Target child plays alone and there is not any peer within 3 feet. Target child does not have mutual eye gaze with any peer.
Proximity	Target child plays alone within 3-foot range of peer and is not engaged in a similar activity.
Onlooker	Target child shows one-way awareness of child who is 3 feet away. Target child appears to be watching a specific peer or a group of peers or a game with interest or the intent to participate.
Parallel Play	Target child and peer occupied in similar activity but there is not social behaviour.
Parallel Aware	Target child and peer occupied in similar activity and mutually aware of each other.
Joint Engagement	Target child and peer occupied direct social behaviour, activities with a turn taking structure.
Games with Rules	Target child participants in organised games/sports with rules such as tennis, basketball, 4-square
Discrete interactive behaviours Description	
Interaction is initiated by the target child, e.g. greets, asks to play games, offers objects, states facts, etc.	
Target child responds to an approach of peer with a nonverbal gesture, or verbal language.	

Appendix 5 Post-intervention interview questions with TA

Lego therapy semi-structured interview:

A. Introduction:

To collect information about your experience of delivering the Lego therapy the past 8 weeks. To support me in researching the Lego therapy. I will audio record the interview. The purpose of the attached consent form is to request your permission to audio record the interview session.

B. Confidentiality:

Information gathered during the interview will be audio-recorded, transcribed and analysed. It will be anonymised so that nobody should be able to identify them from quotes taken from the interview. All the information will be kept strictly confidential. It will be kept in password secured laptop. Audio-recordings will only be accessed by the research team. It will be destroyed once the research has been assessed. At the end of the project, I will publish my findings in a thesis. I will also present the project to professional and academic communities. At no time will you be identified by name during any part of these activities.

C. Format of the interview:

The Interview will last for about half an hour. I will ask you some questions and there are no right and wrong answers – I would just really like to hear your views about Lego therapy. If at any point you would like to stop or do not want to answer the question then please let me know and we can have a break or leave out the question.

Rapport building:

How long have you been working as TA?

Can you talk me through a typical working day?

Did you have any experience of working with children with autism prior to delivering the Lego therapy? If yes, can you share your experience.

I am going to start recording now. Do you have any questions before we start?

Effectiveness of Lego therapy:

So now that you have conducted eight weeks Lego therapy sessions, I'd like to ask you about your views on how you found it and whether you think it was effective.

General Views

1. How did you find delivering Lego therapy?
2. Can you tell me about what you think went well about Lego therapy?
   Prompts:

   (Expand the idea, anything else went well, examples)

3. Can you tell me about what you think didn't go well about Lego therapy?
   Prompts:

   (Expand the idea, anything else didn't go well, examples)

   (What were the challenges?)

   (Did you have any issues when delivering the Lego therapy?)

Children's Views

4. How did the children in your group find the sessions? (e.g. interest; examples)
5. Did any particular child draw your attention in a positive or negative ways throughout the sessions?
   Prompts:

   (Did any particular child dominate the sessions?)

   (Did any particular child display significant positive behaviour throughout

   the sessions?)

   (Did any particular child display significant negative behaviour throughout

   the sessions?)

   (Did any particular child contribute significantly to the collaborative play?)

Benefits

6. What, if any, changes have you seen in the group throughout the whole therapy?
   Prompts:

   (Did the group seem to engage more as the weeks gone by?)

   (Did the group seem to understand their roles?)

   (Have you observed any benefits in their language and communication

   skills?)

   (How about their interaction?)

7. What, if any, changes have you seen in particular child within the group throughout therapy?
   Prompts:

   (Any changes of behaviour)

   (Any changes of emotion)

8. Do you work with any of the children outside the Lego therapy session? If yes, have you seen any changes outside the sessions? If not, have any other members of staff observed any changes?
   Prompts:

   (Any changes in the relationship with other peers?)

   (Structured situations, such as classroom or structured play?)

   (Non-structured situations, such as free play?)

Practicality:

9. Did you feel you were supported sufficiently to run the intervention on a weekly basis?
10. Have you had opportunity to communicate about the therapy sessions with class teacher and SENCo?
11. Would you run the Lego therapy again in the future? Why?
12. Would you recommend Lego therapy to other school staff to run in their school?
13. Is there anything else I haven't asked you about the Lego therapy that you would like to add? Anything that you think is important for me to know for the evaluation?

Thank you for your time and participating the project.

Appendix 6 Interview Consent Form

I volunteer to participate in a research project conducted by Sam Cheng from UCL, IOE. I understand that the project is designed to gather information about the Lego therapy.

1. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.

2. If I feel uncomfortable in any way during the interview session, I have the right to decline to answer any question or to end the interview.

3. Participation involves being interviewed by researchers from UCL, IOE, University of London. The interview will last approximately 30-45 minutes. Notes will be written during the interview. The interview will be audio recorded.

4. I understand that the researcher will not identify me by name in any reports using information obtained from this interview, and that my confidentiality as a participant in this study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.

5. I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

6. I have been given a copy of this consent form.

Name of Participant	Date	Signature
Name of Researcher	Date	Signature

Appendix 7 Lego® therapy Session Checklist Manual

(Brett 2013; LeGoff et al., 2014; Owen et al., 2008):

School:_____Date:_____Session:1/2/3/4/5/6/7/8

TA:_____Children ID:_____

Activity	**Check**	**Comment**
Overall Session		
1. Lego® rules recapped and displayed		
2. 3 Roles recapped and assigned		
3. Structured Lego® building for 30 minutes		
4. Freestyle Lego® building for 15 minutes		
5. Children tidy up Lego®		
6. TA summarised and praised		
7. Pupils play according to role		
8. TA minimises direct support		
9. TA praises for good building		
10. TA praises for good social skills		
11. TA prompts pupils to help each other		
12. TA identifies the social problem		
13. TA directs the social problem to the whole group		
14. Provide opportunity for pupils to problem solve		
15. TA reminds strategies that pupils previously created/practised		

Appendix 8 Debriefing

All relevant stakeholders in this study were given the overall findings:

Children participants: It was done by the researcher and TA facilitator to each Lego therapy group in April, for 5 – 10 mins. Children were thanked for their participation.

TAs: Through meeting with them and offering access to a copy of the final thesis.

Parents: It will be done by a letter including details of the results and evaluation from the researcher once the thesis has been passed.

Schools: Through meeting with the SENCo and offering access to a copy of the final thesis

Local Authority: Through a presentation during educational psychology service team meeting in June.

Appendix 9 Normality test results of the WASI-2, the 3 levels of POPE, the SRS-2

Normality test results of the WASI-II

Tests of Normality

Group		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
pure	IQ	.254	6	.200*	.897	6	.354
	VCI	.162	6	.200*	.960	6	.816
	PRI	.175	6	.200*	.935	6	.621
mixed	IQ	.171	8	.200*	.951	8	.724
	VCI	.170	8	.200*	.939	8	.603
	PRI	.237	8	.200*	.925	8	.475
control	IQ	.229	5	.200*	.913	5	.487
	VCI	.240	5	.200*	.868	5	.259
	PRI	.208	5	.200*	.959	5	.800

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Normality test results of the 3 levels of POPE

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
PreNonSocial	Pure	.199	6	.200*	.957	6	.798
	MIxed	.179	8	.200*	.947	8	.686
	Control	.265	5	.200*	.937	5	.646
PreLowSocial	Pure	.195	6	.200*	.972	6	.903
	MIxed	.232	8	.200*	.938	8	.595
	Control	.141	5	.200*	.979	5	.928
PreHighSocial	Pure	.277	6	.168	.809	6	.071
	MIxed	.171	8	.200*	.936	8	.568
	Control	.156	5	.200*	.995	5	.993
PostNonSocial	Pure	.186	6	.200*	.932	6	.595
	MIxed	.276	8	.074	.802	8	.030
	Control	.293	5	.187	.778	5	.053
PostLowSocial	Pure	.288	6	.132	.803	6	.062
	MIxed	.206	8	.200*	.939	8	.597
	Control	.349	5	.046	.771	5	.046
PostHighSocial	Pure	.268	6	.200*	.826	6	.099
	MIxed	.212	8	.200*	.939	8	.602
	Control	.274	5	.200*	.857	5	.216

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Normality test results of the SRS-2:

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
PreAware	Pure	.289	6	.128	.828	6	.103
	Mixed	.163	8	.200*	.969	8	.889
	Control	.233	5	.200*	.907	5	.451
PreCog	Pure	.230	6	.200*	.937	6	.639
	Mixed	.267	8	.099	.844	8	.082
	Control	.164	5	.200*	.986	5	.965
PreCom	Pure	.148	6	.200*	.990	6	.989
	Mixed	.158	8	.200*	.939	8	.598
	Control	.257	5	.200*	.882	5	.318
PreMot	Pure	.213	6	.200*	.903	6	.393
	Mixed	.144	8	.200*	.923	8	.458
	Control	.211	5	.200*	.933	5	.616
PreRRB	Pure	.203	6	.200*	.913	6	.456
	Mixed	.215	8	.200*	.945	8	.663
	Control	.179	5	.200*	.969	5	.866
PreTotalT	Pure	.206	6	.200*	.911	6	.446
	Mixed	.280	8	.065	.846	8	.086
	Control	.220	5	.200*	.889	5	.350
PostAware	Pure	.145	6	.200*	.993	6	.995
	Mixed	.285	8	.055	.865	8	.134
	Control	.310	5	.132	.882	5	.321
PostCog	Pure	.210	6	.200*	.930	6	.582
	Mixed	.251	8	.148	.822	8	.048
	Control	.205	5	.200*	.938	5	.651
PostComm	Pure	.207	6	.200*	.911	6	.440
	Mixed	.224	8	.200*	.868	8	.143
	Control	.276	5	.200*	.883	5	.321
PostMot	Pure	.206	6	.200*	.923	6	.526
	Mixed	.167	8	.200*	.913	8	.375
	Control	.345	5	.053	.776	5	.051
PostRRB	Pure	.157	6	.200*	.989	6	.987
	Mixed	.151	8	.200*	.970	8	.896
	Control	.271	5	.200*	.875	5	.288
PostTotalT	Pure	.219	6	.200*	.872	6	.234
	Mixed	.258	8	.125	.826	8	.053
	Control	.284	5	.200*	.841	5	.167

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Appendix 10 Descriptive statistics of the 7 social interaction codes of the 3 groups

		Pure			Mixed			Control		
Variable	**Period**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**
POPE – Solitary (Non-social)	Pre	3.67	2.58	6	13.38	8.23	8	8.6	5.59	5
	Post	3.5	2.88	6	10.13	8.01	8	8	4.85	5
	Difference	-.17	.3		-3.25	-.22		-.6	-.74	
POPE – Proximity (Non-social)	Pre	2.67	2.5	6	1.63	1.6	8	2.8	2.77	5
	Post	1.67	1.63	6	1.88	1.36	8	2	1.58	5
	Difference	-1	-.87		.25	-.24		-.8	-1.19	
POPE – Onlooker (Low-social)	Pre	8.5	5.24	6	3.75	1.83	8	2.6	.89	5
	Post	7.67	3.44	6	4.88	2.42	8	4.4	1.81	5
	Difference	-.83	-1.8		1.13	.59		1.8	.92	
POPE – Parallel Play (Low-social)	Pre	1	1.26	6	1.13	1.55	8	1.6	1.14	5
	Post	.5	0.83	6	.75	.71	8	1.6	1.67	5
	Difference	-.5	-.43		-.38	-.84		0	.53	
POPE – Parallel Aware(Low-social)	Pre	2.17	1.17	6	1	1.2	8	2	1.41	5
	Post	3.67	2.07	6	1.63	1.3	8	2.6	1.82	5
	Difference	1.5	.9		.63	.1		.6	.41	
POPE – Joint Engagement (High-social)	Pre	4	3.46	6	5.25	4.4	8	6.6	3.29	5
	Post	4.5	1.97	6	5.63	3.07	8	4.8	2.28	5
	Difference	.5	-1.49		.38	-1.33		-1.8	-1.01	
POPE – Games (High-social)	Pre	8	4.05	6	3.88	4.85	8	5.8	4.71	5
	Post	8.5	2.51	6	5.13	4.32	8	6.6	4.39	5
	Difference	.5	-1.54		1.25	-.53		.8	-.32	

Appendix 11 Sample of the TA intervention transcript and thematic analysis

Interviewer: Now you have completed an 8 weeks of Lego therapy sessions. I'd like to ask your views on how you found it and whether you think it was effective. How did you find delivering Lego therapy?

D: First of all, the children absolutely enjoyed it. Every week, they would be looking out their classroom window. "When is Miss C coming? When is Miss C coming?" They knew exactly when the time was.

motivated to join Lego therapy

The children who were doing the Lego therapy club, were very enthusiastic and they wanted to do it. I think because it's Lego, it helps a lot. A lot of children enjoy LEGO. It helps them with their enthusiasm and eagerness to participate.

motivated to join Lego therapy

Reason of motivation.

Good understanding of role.

With my sessions, the children did their roles really well. In the beginning, it's about setting down the rules, setting down the boundaries, making sure they understand exactly what is required of them. Before every session, we would really delve into that, before every single session of their 8 weeks, just so that it was consistent for them, as well. There wasn't any change. We would always go to the same place, as well, so that they knew where they were going. It was routine for them. The same time so that it would help with their management and the way they kind of had things in their time tables so they would find it easier.

Ensure children understand Lego Structure.

Consistent Recap on Rules.

Consistent Structure of Lego therapy.

What else was the question?

Interviewer: No, that's fine. Can you tell me about what you think went well about Lego therapy.

D: What went well in my particular group is that they were very good at designating the roles themselves. I didn't have to go and say "You're this and you're that. You're this." They took charge of the group. I was there to guide them. They were the ones who ... They sat properly. They were like "I will be the engineer. What do you think? What do you want?" They'd even ask questions like "Is that okay?" They had that kind of understanding of "Would that be okay with the other person, if I did this?" They assigned their own roles but what we would do afterwards was discuss what their roles were.

Children good at designating their roles.

Children took charge the group → TA to guide the children.

Children assign their roles. → Joint Discussion on roles.

Discussion on roles.

Interviewer: That's good. That's really good.

D: They would choose engineer, supplier, and the builder. I tell you what, "What's your role? What's your role? What's your role?" Everyone had to listen to each other and that was reinforced at the beginning of every session so that they wouldn't forget.

Reinforce listening to each other.

good Rotation on Role. → They rotated it really well. I didn't even have to say to them ... Well, in the beginning, I did. What roles are you guys going to do this week and they pretty much, on their own, decided to change it up in the beginning. There was a child who did enjoy being the

Children took charge to rotate role.

D

unwilling to change role

supplier a bit too often, he did really enjoy it but then, we as a group, said "If we were always in the same role, would that be beneficial? By experiencing the same thing all the time, how will you know how the other roles are like? You may enjoy that." Just by questioning that, to make him kind of think "Well actually." Then he would be like, "Actually, I think I want to try the builder next time". We would discuss it a lot. By doing different things, you learn different things and therefore it's best to try new things.

TA guiding children to problem solve.

TA question the children to get them think.

Trying new role

Discussion on learning different things by trying.

What else went well?

Effective communication

They communicated really well. They did follow the rules quite well. Once in a while, where'd I have to say "Okay" and talk to one of the children "Okay, you need to stop touching you, if they were the supplier." Particularly if they were the supplier. "What do you need to remember? You need to remember to listen, everybody. We have to be polite. How are we polite?"

obedience

TA prompt

Reminder of the nature of the role.

TA guiding

It's the question. It's not really telling them what they have to do. It's the question that is going to make them think about it. The guiding and more along that line so that they have an understanding of what they need to do.

TA guiding

If they struggled, I'd ask the other children "What do you think?" and they give their opinion. Then it goes back to that child.

"Okay. Do you understand?"

[Child] "Yes."

"So what are you doing to do?"

[Child] "Yes."

Provide opportunity for the child to practice appropriate behaviour.

We'd both be sitting there with our arms crossed to make sure he doesn't touch the pieces in the middle.

Implusiveness of touching Lego.

That was tempting for one of the kids in particular. Very tempted to keep touching it but when that child was the engineer, he was amazing. Very patient, I found that, initially, when we started these sessions, some of their patience was lacking a little bit.

patience

changes impatient

Language Difficulties

It's understandable, you are trying to explain what to do and the person is just not getting it. One of the kids would be like "I told you that about a million times" but it wasn't rude, it was ... it's not like that, "I've said that about a million times."

Require to repeat instruction many times.

change: relax.

After that they realized, "Okay" and just relax. That was maybe one session and then after a couple of sessions, they realized "That's not how we speak to each other. Let's be patient."

Model: patient

[redacted] I must say was very, very patient. Very, very patient when he was instructed. He had a really nice tone to his voice and when it was going on, let's say when [redacted] was

getting the piece together, putting it right, he would just be like "No, not like that. Try it another way." They were really good at the vocabulary because we did go through vocabulary before with instructions as well. I'd model it and be like "What am I doing here?". On top of. Underneath. Next to. Side-by-side. Then they'd have to give me the vocabulary, just so that they were aware of what keywords to say as well.

Interviewer: Sure.

D: We also went over how the studs were at the top so they kind of knew that. What other adjectives can you use to describe the LEGO. They did that.

When they would say something really positive, I would praise them a lot. For example, last week, Dominic was the engineer and Elion was the builder. [redacted] wasn't getting it. he wasn't putting it in the right slot and then [redacted] said "Okay, flip it. Flip it to the other side". I really liked how he said "Flip. Flip the LEGO around" and I said "[redacted] that is really good". At the end of the session, when they achieve their target successfully, we get together and we say what went well about that session so they all have a chance to speak. [redacted] said "I used the word flip. I helped him because he was ...." He actually said that "He wasn't doing it right the first time so when I used another word, it helped him." Even [redacted] during the session, he actually said out loud, "Well, maybe if I try it like this, it might work." They were thinking of different ways to do it and they were asking each other "If I try it like this. Maybe this will work" and [redacted] would be like "Yeah. Try it like that." They were encouraging each other.

[redacted] was very good at supporting the other two, actually. He would really try motivate them. "You can do this. Don't give up."

Interviewer: Yeah, I saw that.

D: "We can do this. Persevere." That was their main word that they loved. "We need to persevere", if one particular task was a bit tricky. They achieved every task. The main thing is that they were patient and supportive of one another.

Interviewer: Sure. Thank you. That's really good.

Can you tell me about what you think didn't go well in Lego therapy? Challenges?

Okay. I think, for one of the children in particular, it was mainly the attention. He was very much ... Like, he would look around a lot. When he didn't have a ... When he was a supplier, he found it very difficult to sit still and just wait and listen. He'd be distracted, not in a rude way. He wasn't called out or rude to the other two but you could tell he was looking around, looking at the corners, fleeting eye contact between the two children. In fact, actually, there was [redacted] as well. Again, in the beginning, very fleeting eye contact. When he would look at them and just look away across their eyes but as the sessions progressed, he improved on that.

Difficulties: Staying on topic. → (As well, staying on topic. I guess this is more for afterwards when they were on free play, (If they were asking each other questions, they all wanted to get a question in and ask each other questions that it just got a bit confusing as to who was talking sometimes) Again, that was mainly in the beginning. Then the topic would change. Their topic maintenance was a bit distorted sometimes but it progressed as we went on. That was initially what was difficult because someone was really excited to say something and then the other person who was talking about something else was a bit confused, in that sense. As the session progressed, again, I'm talking about patience, and I'm taking it turns to speak and to voice their opinion about what they thought in that session went well. They were taking turns. At first it was like "Well, I thought and I thought" and it was all at once but then they realized "Actually, you need to listen" and take turns between the two.

Difficulties: → too Conversation skills.

Change: Improve in topic maintance →

Difficulties: → topic maintance

change: turn taking.

Interviewer: How did the children in the group find the sessions? They show enthusiastic, you said. How did they feel about the session in general?

proud and excited about Lego therapy

D: They were excited. To be honest, they thought it was their own special little group. They took ownership of the group. They were proud to be coming out.

Interviewer: Really?

Spoke Highly of Lego Therapy

D: They couldn't wait to come out. They spoke very highly of the session every time it finished. They would walk front and front and I could here them talking and they were like "Awh. That was so good. That was so good." They enjoyed the free time as well. With each success, they had longer free play with the LEGO. They did pretty much achieve it in good time so they quite a long time for free play. They enjoyed that aspect. They really ... As the weeks progressed, you could really see them talking to each other and engaging with each other a lot more. When they built something in free play, they would show each other and say "Come out and have a look at this." They would sometimes work together as a team and they would help each other add things onto a house they were making.

Children had positive feeling towards Lego therapy →

Enjoy free-time period.

change: engage with each other more. →

work as a team.

sharing

Interviewer: Sure. That's really good.

D: They were pleased to be doing that.

Interviewer: That's good.

Did any particular child draw any attention in a positive or negative way? I say positive first.

D: They were all good in their own ways. They all had different parts that excelled.

One child in particular, who stood out, was [redacted].

Interviewer: Yeah, you mentioned him. He is the motivator

D

Appendix 12 Checklist completion for each group

Groups	Observed	Expected	Percentage	$(O-E)^2$	$(O-E)^2/E$
A(Pure)	**111**	**120**	92.50%	81	0.73
B(Mixed)	**101**	**120**	84.17%	361	3.57
C(Mixed)	**114**	**120**	95.00%	36	0.32
D(Pure)	**100**	**120**	83.33%	400	4.00
E(Mixed)	**104**	**120**	86.67%	256	2.46
F(Mixed)	**100**	**120**	83.33%	400	4.00

Appendix 13 The programme fidelity completion percentage in each group

	Group					
Checklist items	**A**	**B**	**C**	**D**	**E**	**F**
1. Lego® rules recapped and displayed	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
2. 3 Roles recapped and assigned	**100%**	**100%**	**100%**	**88%**	**100%**	**88%**
3. Structured Lego® building for 30 minutes	**100%**	**100%**	**88%**	**100%**	**88%**	**100%**
4. Freestyle Lego® building for 15 minutes or more	**100%**	**88%**	**100%**	**100%**	**88%**	**88%**
5. Children tidy up Lego®	**88%**	**88%**	**100%**	**88%**	**100%**	**88%**
6. TA summarised and praised	**88%**	**88%**	**100%**	**100%**	**88%**	**100%**
7. Pupils play according to role	**88%**	**75%**	**88%**	**75%**	**88%**	**100%**
8. TA minimises direct support	**75%**	**63%**	**88%**	**63%**	**88%**	**63%**
9. TA praises for good building	**100%**	**100%**	**100%**	**88%**	**100%**	**75%**
10. TA praises for good social skills	**100%**	**88%**	**100%**	**63%**	**75%**	**88%**
11. TA prompts pupils to help each other	**88%**	**88%**	**88%**	**88%**	**75%**	**75%**
12. TA identifies the social problem	**100%**	**75%**	**100%**	**75%**	**100%**	**88%**
13. TA directs the social problem to the whole group	**75%**	**88%**	**75%**	**75%**	**63%**	**63%**
14. Provide opportunity for pupils to problem solve	**100%**	**63%**	**100%**	**63%**	**75%**	**75%**
15. TA reminds strategies that pupils previously created/practised	**88%**	**63%**	**100%**	**88%**	**75%**	**63%**

Appendix 14 Intra-Class Correlation data

Case Processing Summary

		N	%
Cases	Valid	35	100.0
	Excluded[a]	0	.0
	Total	35	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.950	.950	2

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.908[a]	.826	.953	20.190	34	34	.000
Average Measures	.952[c]	.904	.976	20.190	34	34	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type A intraclass correlation coefficients using an absolute agreement definition.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Appendix 15 Ethics Application

Ethics Application Form:

Student Research

All research activity conducted under the auspices of the Institute by staff, students or visitors, where the research involves human participants or the use of data collected from human participants are required to gain ethical approval before starting. *This includes preliminary and pilot studies.* Please answer all relevant questions responses in terms that can be understood by a lay person and note your form may be returned if incomplete.

For further support and guidance please see accompanying guidelines and the Ethics Review Procedures for Student Research http://www.ioe.ac.uk/studentethics/ or contact your supervisor or researchethics@ioe.ac.uk.

Before completing this form you will need to discuss your proposal fully with your Supervisor/s.

Please attach all supporting documents and letters.

For all Psychology students, this form should be completed with reference to the British Psychological Society (BPS) Code of Human Research Ethics and Code of Ethics and Conduct.

Section 1 Project details

a.	Project title		Investigate the effectiveness of Lego Therapy
b.	Student name and ID number (e.g. ABC12345678)		Yuk Fai Sam Cheng (CHE14120623)
c.	Supervisor/Personal Tutor		Prof. Peter Blatchford / Dr. Ioanna Bakopoulou
d.	Department		IOE-Psychology & Human Development
e.	Course category (Tick one)	PhD/MPhil ☐	EdD ☐
		MRes ☐	DEdPsy ☒
		MTeach ☐	MA/MSc ☐
		ITE ☐	

		Diploma (state which) ☐	
		Other (state which) ☐	
f.	Course/module title		Doctorate in Professional Educational, Child and Adolescent Psychology
g.	**If applicable,** state who the funder is and if funding has been confirmed.		
h.	Intended research start date		April 2015
i.	Intended research end date		July 2016
j.	Country fieldwork will be conducted in *If research to be conducted abroad please check www.fco.gov.uk and submit a completed travel risk assessment form (see guidelines). If the FCO advice is against travel this will be **required** before ethical approval can be granted: http://ioe-net.inst.ioe.ac.uk/about/profservices/international/Pages/default.aspx*		England

k.	Has this project been considered by another (external) Research Ethics Committee?	
	Yes ☐	External Committee Name:

	No ☒ ⇨ *go to Section 2*	Date of Approval:

If yes:

- Submit a copy of the approval letter with this application.
- Proceed to Section 10 Attachments.

Note: Ensure that you check the guidelines carefully as research with some participants will require ethical approval from a different ethics committee such as the National Research Ethics Service (NRES) or Social Care Research Ethics Committee (SCREC). In addition, if your research is based in another institution then you may be required to apply to their research ethics committee.

Section 2 Project summary

Research methods (tick all that apply)

Please attach questionnaires, visual methods and schedules for interviews (even in draft form).

☒ Interviews ☐ Focus groups ☒ Questionnaires ☐ Action research ☒ Observation ☒ Literature review	☒ Controlled trial/other intervention study ☐ Use of personal records ☐ Systematic review ⇨ ***if only method used go to Section 5.*** ☐ Secondary data analysis ⇨ ***if secondary analysis used go to Section 6.*** ☐ Advisory/consultation/collaborative groups ☐ Other, give details:

Please provide an overview of your research. This should include some or all of the

following: purpose of the research, aims, main research questions, research design, participants, sampling, your method of data collection (e.g., observations, interviews, questionnaires, etc.) and kind of questions that will be asked, reporting and dissemination (typically 300-500 words).

Purpose of the research:

1.) Explore how Lego® therapy can help children with autism in mainstream setting, such as social interaction during break time.

2.) Attempt to provide a rationale as what is causing the changes of behaviour of the participants after participating Lego® therapy.

3.) Increase professional links with EPs and Speech and Language therapist. EPs are well placed to work with autistic children as they work in an eco-systemic way and can help identify social needs, and how to support the young person with such needs.

4.) Explore how typically developing participant participates in the therapy group may influence the social interaction of ASC participants.

From the literature review:

1.) Find out what is already known about long term impact on children with underdeveloped social skills.

2.) Find out what is already known about social deficits of children with autism, such as social interaction.

3.) Identify the factors to that could help to improve generalisation of social skills intervention.

4.) Identify the importance of working with typically developing (TD) peers.

5.) Find out what is already known about Lego® therapy.

6.) Find out how Lego® therapy could potentially have an impact on social skills.

Research Aims:

1) To evaluate the effectiveness of an 8-week Lego® therapy group intervention for children with ASC to improve their social interaction and social impairment features.

2) To evaluate the impact of including a TD child in the Lego® therapy group on the social interaction, social engagement and other social behaviours of children with ASC

3) To explore TAs' views of delivering Lego® therapy and their perceptions of the effectiveness of the intervention.

Participants:

This project is targeting to recruit 19 participants with ASC and 4 TD participants. Participant's age: key stage 2. Participants with ASC have the ability to sustain table tasks for 20 minutes. In addition, participants with ASC should not be receiving other social intervention. TD participants' criteria: they do not show any sign of special needs.

Research Design:

Mixed method design is used in this project.

There will be 2 phases to collect quantitative data:

Phase 1: Baseline measure (2 weeks)

Phase 2: Post intervention

There will be 3 measures in order to investigate the effectiveness of LEGO therapy.

Measure 1: Pre-test

Measure 2: Post-test

Measure 3. Post intervention

Qualitative data will be collected at the end of phase 3 by semi-structured interview with teaching assistant who runs the Lego® therapy

Intervention:

Researcher received 2 hours training from a local authority speech and language therapist and researcher will provide training to teaching assistant in order to conduct the intervention. Researcher will conduct the intervention with the teaching assistant in the first session in order to control the quality of the intervention.

Data Collection:

Measures used to create participant profiles:

Wechsler Abbreviated Scale of Intelligence Second Edition (WASI-II)

Pre- and Post- Measures:

1. Social Responsiveness Scale 2nd edition (teacher and parents to complete) (measure 1, 3)

2. Systematic Observation (Measure 1, 3)

    a. Playground observation The Playground Observation of Peer Engagement (POPE; Kasari, Rotheram-Fuller, & Locke, 2010). It is aiming to measure the frequency of different types of interactions and the levels of all social interactions.

Semi-structured interview: Teaching assistant who runs the LEGO therapy will be interviewed in order to answer the 4th and 5th research questions.

Potential questions during semi-structured interview:

1. Describe participant's activity and social interaction during LEGO therapy.
2. Describe changes, if any, in participant's behaviour during therapy
3. Describe positive behaviour, other than social interaction, display by the participants during LEGO therapy

Reporting:

All profiles in this project will be anonymised. All the quantitative date will be analysed by using SPSS. Thematic analysis will be used to analyse the interview data. The script from the thematic analysis will also be anonymised.

Parental consent will be sought before any contact with the participants.

Dissemination:

Recruitment letter will be sent to Sam's local authority EPs, they will forward the letter to their allocated schools. Research briefing will be sent to schools. I will report back my findings to participants' parents if they request this.

Section 3 Participants

Please answer the following questions giving full details where necessary. Text boxes will expand for your responses.

a.	Will your research involve human participants?	Yes ☒	No ☐ ⇨ *go to Section 4*
b.	Who are the participants (i.e. what sorts of people will be involved)? Tick all that apply. **Children with Autism. Typically developing Children. ASD children's parents and teacher, teaching assistant who runs the LEGO threapy.**		
	☐ Early years/pre-school ☒ Ages 5-11 ☐ Ages 12-16 ☐ Young people aged 17-18	☐ Unknown – specify below ☒ Adults *please specify below* ☐ Other – specify below	
	NB: Ensure that you check the **guidelines** (Section 1) carefully as research with some participants will require ethical approval from a different ethics committee such as the National Research Ethics Service (NRES).		
c.	If participants are under the responsibility of others (such as parents, teachers or medical staff) how do you intend to obtain permission to approach the participants to take part in the study? **(Please attach approach letters or details of permission procedures – see Section 9**		

	Attachments.) Please see attached letter. I will meet with SENCos to inform them my research and give them letters to pass to potential participants' parents.
d.	How will participants be recruited (identified and approached)? Recruitment letter will be sent to EPs in my local authority and they will forward the letter to their allocated schools.
e.	Describe the process you will use to inform participants about what you are doing. Project aims and other information will be included in the invitation letter, which will come together with the consent form. School SENCos will be given the invitation letter by their allocated EPs. I will meet with the school SENCos if they show interest about taking part of this project. I will inform teacher and teaching assistant who working with the participants of my work. Participants' parents will receive information letter and the consent form. They will be offered to contact me for any enquires. During the initial session, participants will be informed the current research project. They will also be told their rights to withdraw the study.
f.	How will you obtain the consent of participants? Will this be written? How will it be made clear to participants that they may withdraw consent to participate at any

	time? *See the guidelines for information on opt-in and opt-out procedures. Please note that the method of consent should be appropriate to the research and fully explained.* Participants' parents will be given letter of consent and information letter. This will inform them of their right to withdraw at any time. This will also be reiterated during face to face contact at the start of the session with the participants. I will read out the information and consent form with the young person if necessary. See attachments.
g.	**Studies involving questionnaires:** Will participants be given the option of omitting questions they do not wish to answer? Yes ☒ No ☐
	If **NO** please explain why below and ensure that you cover any ethical issues arising from this in section 8.
h.	**Studies involving observation:** Confirm whether participants will be asked for their informed consent to be observed. Yes ☒ No ☐
	If **NO** read the guidelines (Ethical Issues section) and explain why below and ensure that you cover any ethical issues arising from this in section 8.

i.	Might participants experience anxiety, discomfort or embarrassment as a result of your study? Yes ☐ No ☒
	If **yes** what steps will you take to explain and minimise this? If **not**, explain how you can be sure that no discomfort or embarrassment will arise? **Participants can withdraw the study at any time. Each therapy session will be conducted by the school TA in a child-friendly environment. If participants experience any discomfort in the session, TA will report to SENCo directly. SENCo and I will inform participant's parents and they can withdraw the study at any time.**
j.	Will your project involve deliberately misleading participants (deception) in any way? Yes ☐ No ☒
	If **YES** please provide further details below and ensure that you cover any ethical issues arising from this in section 8.
k.	Will you debrief participants at the end of their participation (i.e. give them a brief explanation of the study)?

	Yes ☒ No ☐
	If **NO** please explain why below and ensure that you cover any ethical issues arising from this in section 8.
l.	Will participants be given information about the findings of your study? (This could be a brief summary of your findings in general; it is not the same as an individual debriefing.) Yes ☒ No ☐
	If **no**, why not?

Section 4 Security-sensitive material

Only complete if applicable

Security sensitive research includes: commissioned by the military; commissioned under an EU security call; involves the acquisition of security clearances; concerns terrorist or extreme groups.

a.	Will your project consider or encounter security-sensitive material?	Yes ☐ *	No ☒
b.	Will you be visiting websites associated with extreme or terrorist	Yes ☐	No ☒

	organisations?	*	
c.	Will you be storing or transmitting any materials that could be interpreted as promoting or endorsing terrorist acts?	Yes ☐ *	No ☒

* *Give further details in* ***Section 8 Ethical Issues***

Section 5 Systematic review of research

Only complete if applicable

a.	Will you be collecting any new data from participants?	Yes ☐ *	No ☒
b.	Will you be analysing any secondary data?	Yes ☐ *	No ☒

* *Give further details in* ***Section 8 Ethical Issues***

If your methods do not involve engagement with participants (e.g. systematic review, literature review) ***and*** *if you have answered* ***No*** *to both questions, please go to* ***Section 10 Attachments.***

Section 6 Secondary data analysis Complete for all secondary analysis

a.	Name of dataset/s		
b.	Owner of dataset/s		
c.	Are the data in the public domain?	Yes ☐	No ☐
		If no, do you have the owner's permission/license? Yes ☐ No* ☐	
d.	Are the data anonymised?	Yes ☐	No ☐
		Do you plan to anonymise the data?	Yes ☐ No* ☐
		Do you plan to use individual level data?	Yes* ☐ No ☐
		Will you be linking data to individuals?	Yes* ☐ No ☐
e.	Are the data sensitive (DPA 1998 definition)?	Yes* ☐	No ☐
f.	Will you be conducting analysis within the remit it was originally collected for?	Yes ☐	No* ☐
g.	If no, was consent gained from participants for subsequent/future analysis?	Yes ☐	No* ☐
h.	If no, was data collected prior to ethics approval process?	Yes ☐	No* ☐

* *Give further details in* ***Section 8 Ethical Issues***

If secondary analysis is only method used ***and*** *no answers with asterisks are ticked, go to* ***Section 9 Attachments.***

Section 7 Data Storage and Security

Please ensure that you include all hard and electronic data when completing this section.

a.	Confirm that all personal data will be stored and processed in compliance with the Data Protection Act 1998 (DPA 1998). *(See the Guidelines and the Institute's Data Protection & Records Management Policy for more detail.)*		Yes ☒
b.	Will personal data be processed or be sent outside the European Economic Area?	Yes ☐ *	No ☒

*** If yes,** please confirm that there are adequate levels of protections in compliance with the DPA 1998 and state what these arrangements are below.

c.	Who will have access to the data and personal information, including advisory/consultation groups and during transcription? Research supervisor.

During the research	
d.	Where will the data be stored? On my computer hard drive with secure password. Data will not have identifiers on it. Paper copies will be shredded once analysis process is completed
e.	Will mobile devices such as USB storage and laptops be used? Yes ☒ * No ☐ *** If yes,** state what mobile devices: Laptop *** If yes,** will they be encrypted?: Password protected
After the research	
f.	Where will the data be stored? On computer hard drive and all data will be anonymous, until deleted after thesis passes.
g.	How long will the data and records by kept for and in what format? Raw data will be anonymous and will be kept for 2 years after the thesis has passed in case any future thesis work is planned
h.	Will data be archived for use by other researchers? Yes ☐ * No ☒

	* If yes, please provide details.

Section 8 Ethical issues

Are there particular features of the proposed work which may raise ethical concerns or add to the complexity of ethical decision making? If so, please outline how you will deal with these.

It is important that you demonstrate your awareness of potential risks or harm that may arise as a result of your research. You should then demonstrate that you have considered ways to minimise the likelihood and impact of each potential harm that you have identified. Please be as specific as possible in describing the ethical issues you will have to address. Please consider / address ALL issues that may apply.

Ethical concerns may include, but not be limited to, the following areas:

- Methods
- Sampling
- Recruitment
- Gatekeepers
- Informed consent
- Potentially vulnerable participants
- Safeguarding/child protection
- Sensitive topics
- International research
- Risks to participants and/or researchers
- Confidentiality/Anonymity
- Disclosures/limits to confidentiality
- Data storage and security both during and after the research (including transfer, sharing, encryption, protection)
- Reporting
- Dissemination and use of findings

Intervention will be carried out by school teaching assistant. I have received training to conduct Lego® therapy from a qualified Speech and Language therapist in my local authority. I will provide training to teaching assistants. In addition, the first therapeutic session will be conducted by me and the teaching assistants in order to control the quality of the intervention.

The sampling will be drawn from school SENCos. They will identify potential participants who meet the criteria. The sample of young people in the study will

be purposeful sampling using an opportunistic technique.

Information about the study will be given to SENCos so they can pass on to potential participants' parents. Teachers and other staff who work with participants will also be given the information. Participants' parents, teachers and SENCos can then contact me if they have enquires about this project. Parents will contact and sign the consent form if they agree their children to participate this project. In the parental consent form, it will emphasise that although it is hoped that the intervention will benefit the participants, there is no guarantee of positive change.

Parents are offered the opportunity to receive, discuss their child's assessment findings and their progress throughout the whole project. If participants become agitated or anxious during the study, a short break will be provided. Participants will be offered to carry on or terminate the session. This incident will be reported to the SENCo, teacher and supervisor.

During playground observation, observer will be as unobtrusive as possible. A second observer will also be recruited, and this person will have DBS checked and school staff will be informed in advance about the second observer. Those conducting the observations need to know their way around schools, be able to put teachers and pupils at ease, avoid passing judgements, and use the observation schedule as intended. It is important to acknowledge and emphasise that the aim of the project is to see what goes on in the playground on a day-today basis. Judgement will not be made and main focus is the pupils.

Good communication will be established with school staffs and participants. They are entitled to seek any information about the research and the children's progress.
Semi structured interview context will be focused on the child's social interaction in playground, such as their behaviours, activities, frequency of interactions and context. Thematic analysis will be used to analyse the interview data. The script from the thematic analysis will be anonymised.

Section 9 Further information

Outline any other information you feel relevant to this submission, using a separate sheet or attachments if necessary.

N/A

Section 10 Attachments Please attach the following items to this form, or explain if not attached

a.	Information sheets and other materials to be used to inform potential participants about the research, including approach letters	Yes ☒	No ☐
b.	Consent form	Yes ☒	No ☐
	If applicable:		
c.	The proposal for the project	Yes ☐	No ☐
d.	Approval letter from external Research Ethics Committee	Yes ☐	No ☐
e.	Full risk assessment	Yes ☐	No ☐

Section 11 Declaration

Yes No

I have read, understood and will abide by the following set of guidelines.

☒ ☐

BPS ☒	BERA ☐	BSA ☐	Other (please state) ☐

I have discussed the ethical issues relating to my research with my supervisor.

☒ ☐

I have attended the appropriate ethics training provided by my course.

☒ ☐

I confirm that to the best of my knowledge:

The above information is correct and that this is a full description of the ethics issues that may arise in the course of this project.

Name	Yuk Fai Sam Cheng
Date	12/9/2015

Appendix 16 **Practicalities of implementing Lego® therapy in a school setting:**

Environment: Lego® therapy is suggested to be implemented in the same room throughout the whole invention in order to reduce distractions for students with ASC.

Resources: A large amount of Lego® pieces is suggested to be used for the intervention in order to motivate participants to enjoy Lego® therapy.

Participants: Not all children with ASC are suitable for Lego® therapy. This intervention should be recommended by speech and language therapist, educational psychologist and SENCo in order identify the most suitable children to participate. Regular reviews should also be conducted to monitor children's progress.

Training: Some schools may have teaching staff to carry out Lego® therapy, training should be provided by speech and language therapists or educational psychologists. In addition, regular meetings should be arranged between teaching staff and the trainer in order to support the implementation process. Participants' social skills should also be monitored by the school regularly in order to measure the effectiveness of Lego® therapy for the participants.

Appendix 17 List of abbreviations and acronyms:

ABA	Applied Behavioural Analysis
ABC	Aberrant Behaviour Checklist
ANCOVA	Analysis of Covariance
APA	American Psychological Association
ASC	Autism Spectrum Condition
DEdPsy	Doctorate in Professional, Educational, Child and Adolescent Psychology
DfE	Department for Education
DSI	Duration of Social Interaction
DSM	Diagnostic Statistical Manual of Mental Disorders
ED	Executive Dysfunction
EF	Executive Function
EP	Educational Psychologist
E-S	Empathising-Systemising
FSIQ	Full Scale IQ
GARS	Gilliam Autism Rating Scale
ICC	Intra-class correlation coefficient
MVSA	Maximum Variation Sampling Approach
NAS	National Autistic Society
N-CBRF	Nisonger Child Behaviour Rating Form
PDD-NOS	Pervasive Developmental Disorder-not Otherwise Specified
PMI	Peer Medicated Intervention
POPE	Playground Observation of Peer Engagement
PRI	Perceptual Reasoning Index
REPIM	Reciprocal Effects Peer Interaction Model

SISC	Self-initiated Social Contact
SLT	Speech and Language Therapist
SPRinG	Social Pedagogic Research into Grouping
SRS	Social Responsiveness Scale
SULP	Social Use of Language Program
TA	Teaching Assistant
TD	Typically Developing
TEP	Trainee Educational Psychologist
ToM	Theory of Mind
VABS	Vineland Adaptive Behaviour Scale
VCI	Verbal Comprehension Index
WASI-II	Wechsler Abbreviated Scale of Intelligence 2nd Edition