Exploring the self-reference effect and its educational applications in typically developing children and children with Attention Deficit Hyperactivity Disorder

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by

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I, Zahra Ahmed, hereby certify that this thesis submitted in partial fulfilment of the requirements for the award Masters by Research, Abertay University, is wholly my own work unless otherwise referenced or acknowledged. This work has not been submitted for any other qualification at any other academic institution.

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Supervisor's declaration:

I, Sheila Cunningham hereby certify that the candidate has fulfilled the conditions of the Resolution and Regulations appropriate for the degree of Masters by research in Abertay University and that the candidate is qualified to submit this thesis in application for that degree.

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I certify that this is a true and accurate version of the thesis approved by the examiners, and that all relevant ordinance regulations have been fulfilled.

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Abstract

Introduction: It has been discovered that items, events, or actions which are encoded self-referentially result in a memory advantage. This has been termed the 'self-reference effect'. There is a lack of research concerning self-referential processes within typically developing children, and children diagnosed with ADHD as well as the educational applications of the self-reference effect. **Objectives:** Experiment 1 measured evaluative and physical self-referential processes within typically developing children and the efficacy of self-referencing methods within an educational task. Experiment 2 replicated the study and compared performance between children with ADHD and a matched control sample. **Results:** In Experiment 1, children displayed a source memory advantage for self-related items, and better recall for self-performed actions. Within the educational task, there was a ceiling effect and therefore no attention and memory advantage was observed following self-encoding. Within Experiment 2, typically-developing and ADHD groups showed overall better memory for actions performed by the self. Children with ADHD showed no difference in self and other item memory in the evaluative self-referencing task. Among both groups within the educational task, a ceiling effect was observed. **Conclusion:** The study is the first to explore and provide potential evidence of physical self-referential biases within ADHD children, adding to our basic understanding of the self-construct within the clinical group. Children with ADHD showed a similar physical but not cognitive self-reference effect as typically developing children, suggesting that reduced attentional capacity may impact on the effects of the self. Implications and ideas for further research are discussed.

Contents

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The topic of self is prevalent across multiple domains including psychology and cognitive neuroscience. Following James' (1890) theory that the self is intricate and comprised of several aspects, rather than a unitary construct, subsequent research examined the possible facets of the self (e.g. Lewis, 1990; Neisser, 1995; Dennet, 1991). Lewis (1990) suggested that the development of our self-concept is comprised of two important parts: the existential self, the 'I' and categorical self the 'me'. The existential self refers to the most basic aspect of our self-concept. It is our awareness of being a separate entity from others as well as understanding the constancy of the self; that we continue to exist over time and space (Bee, 1992). Following the understanding that we exist as a distinct being from others, the categorical part of our self-concept relates to our awareness of being an object in the world. It is the knowledge that just as other objects and individuals possess characteristics, the self can also be placed into categories, such as gender, beliefs, behaviour and values. In early childhood (two to seven years), the categories that are applied are very simple and concrete (e.g. Hart & Damon, 1988), such as referring to hair colour, likes and dislikes. As we reach adolescence (twelve to eighteen years) these categories develop in complexity, such as referring to psychological characteristics (e.g. Lewis & Brooks-Gunn, 1979).

As language is concrete during early childhood (Hart & Damon, 1988), self-report measures may not be appropriate for measuring the self-concept during early development. Additionally, language inadequacy during infancy limits a child's ability to convey any thoughts about themselves. Consequently, a basic mirror test was

developed to measure the onset of the self-concept (Gallup, 1970; Amsterdam, 1972). The researchers independently constructed this paradigm to examine self-awareness in nonhuman primates and human infants. The test involves placing a mirror in front of the individual and observing how the subject reacts. When testing infants, experimenters surreptitiously place some sort of marker on the child's face, such as a spot of rouge (Asendorf, Warkentin, & Baudonniere, 1996). The infant is then presented with a mirror and their behaviour upon seeing their reflection is examined. Awareness of the mark, through various forms of behaviour such as physically reaching it to erase the mark off, enquiring about it or showing embarrassment are indicative that the infant has recognised themselves in the mirror thus developed self-awareness. Typically, this occurs from 18 months (Amsterdam, 1972; Asendorf & Baudonniere, 1993; Lewis & Ramsay, 2004; Nielsen, Suddendorf, & Slaughter, 2006). This finding suggests that infants begin to recognise themselves as an object in the environment, developing their objective self-awareness. Moreover, at around two years of age children begin to display secondary emotions such as embarrassment, envy, and pride signifying the development of self-consciousness. This suggests that children have come to understand that they are an object of another individual's attention (Lewis, 2003). Additional patterns of self-development include the use of personal pronouns at the age of two, such as when the child indicates an item (e.g. a toy) is theirs using pronouns such as 'mine', and the use of additional pronouns including 'me' and 'I' (Lewis, 1991).

The emergence of the self-concept marks an important milestone in development. It is argued that the self-concept is a pre-requisite for the development

of autobiographical memories. The reason this occurs is because it enables the systematic storing of life events as memories because the self plays a central referent role (Howe & Courage, 1993). The earliest retrospective reports of life events occur from two years of age (Pillemer & White, 1989; Usher & Neisser, 1993), which co-occurs with the onset of mirror self-recognition. Memories for early childhood (around two to seven years) are relatively rare, coinciding with slow growth in the self-concept (Halpin, Puff, Mason & Marston, 1984). As the self-concept matures during the transition into adolescence and adulthood, memories of past experiences become more detailed.

A wide range of research within the adult literature has found that the self plays an important role on various cognitive functions, including prioritised attention for self-cues (Cherry, 1953; Moray 1959; Tacikowski & Nowicka, 2010) and a memory advantage for self-related information (Rogers, Kuiper & Kirker, 1977; Symons & Johnson, 1997). Attention to self-information results in an increased likelihood of successful retrieval of the processed information from memory (Klein & Loftus, 1988). Despite knowledge of self- development, there is little understanding of how the self can influence cognition in childhood. The present study will aim to gain a better understanding of the developing self in children, and the role that self-bias processes may play in attention and memory. The research will also examine how self-bias cognitive processes may have real world-impact, by exploring self-interventions and its efficiency in supporting learning among primary school aged children. Another important area, in which there is a lack of research, is self-processes within children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). As stated In the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; APA, 2013)

ADHD is characterised by various symptoms of inattention as well as hyperactivity and impulsivity. Indictors of inattention can include difficulties focussing on a task, making regular errors, forgetfulness during daily tasks and inability or lack of listening when directly spoken to. The child may also on many occasions fail to follow through on instructions and complete schoolwork. There may be evidence of distraction by external stimuli, aversion to tasks that require mental effort, and difficulties in organising tasks and activities. Symptoms of hyperactivity and impulsivity include regular fidgeting, excessive talking, inability to participate in activities quietly, not being able to remain seated when it is necessary (such as in the classroom). Additional indicators are regularly being 'on the go', running and climbing during inappropriate times, difficulties in waiting for their turn and regularly interrupting others. A child is diagnosed with ADHD if six or more of the symptoms have been present for at least six months, are not consistent with their developmental level and are affecting important areas of functioning such as social and academic life.

The group is not homogenous, as ADHD can present differently within the clinical group. Depending on the prevalence of symptoms, the child could have combined presentation of both hyperactivity/impulsivity and intention, or they may be predominately inattentive, or predominantly hyperactive/impulsive. The severity of ADHD can also differ, from mild, moderate to severe impairment. All presentations and levels of severity impair functioning and result in struggles with sustained attention and memory. It is therefore of value to explore whether self-referencing methods can offer a pertinent intervention. The present study will aim to apply self-referencing to better understand the self in ADHD as well as test the effectiveness of self-interventions in education.

1.1 The self and attention

Attention is a complex, yet fundamental aspect of cognition and plays a critical part in human behaviour. Attention is the ability to select and focus on aspects in the environment whilst simultaneously being able to ignore irrelevant or distracting stimuli (Pashler, 1998). Research has revealed that the self plays an important role in attention as there seems to be priority placed on self-related stimuli, which ultimately leads to a memory advantage (Klein & Loftus, 1998; Rogers et al., 1977). Evidently, attention plays a central role in influencing other cognitive functions, demonstrating the importance of prioritising the study of attention. The idea of self and its role on attention was proposed following findings during the classic cocktail-party phenomenon which was conducted using a dichotic listening task (Cherry, 1953). The dichotic listening task involves presenting participants with two different streams of messages to either ear with the utilisation of headphones. Subjects are then instructed to only attend to one ear by repeating (shadowing) the digits or words presented whilst ignoring what is presented in the other ear. Cherry (1953) found that participants had the ability to focus their attention on one source, despite there being two channels of auditory stimuli. Interestingly, it was also discovered during this task that if the participant's name was spoken in the unattended ear then there was an increased chance of participants noticing this. They could recall hearing their name despite it being presented in the unattended ear. Supporting evidence comes from Moray (1959) in which the only words that were prone to recall from the unattended channel were words that held importance to the participant, such as the participant's name. This was reported by 33% (4 out of 12) of participants. Overall, the cocktail-party phenomenon had two important findings: firstly, we have the ability to selectively attend to a specific auditory source, much like a person at a party would be able to focus their attention on the people they are

conversing with whilst being able to ignore all other auditory streams. Secondly, hearing one's name in the unattended channel will capture attention, thus if at a party an individual was to suddenly hear their name, despite not focusing their attention on that conversation, then their attention will be captured.

Based on evidence from behavioural studies, Humphreys and Sui (2016) proposed the potential existence of a neural framework which the authors termed the Self-Attention Network (SAN). The framework consists of three nodes. These include the ventromedial prefrontal cortex (vmPFC; Amodio & Frith, 2006; Jenkins & Mitchell, 2011) and left posterior superior temporal sulcus (LpSTS; Sui, He & Humphreys, 2012) which are closely related to the processing of self-related stimuli. The last node includes the dorsolateral prefrontal cortex (DLPFC) and intra-parietal sulcus (IPS) regions (Humphreys & Sui, 2016). Among the nodes, the vmPFC is argued to be the site of self-representation, the LpSTS is emphasised as the attentional region used for bottom-up information processing, and the dorsolateral prefrontal cortex (DLPFC) and intra-parietal sulcus (IPS) regions are argued to be involved in top-down information processing. Kelley, Macrae, Wyland, Caglar, Inati, and Heatherton (2002) assessed whether the self is special in terms of its neural representation. Using functional magnetic resonance imaging (fMRI), participant's brain activity was recorded during a trait evaluation paradigm. Participants were asked to make a judgement on whether trait words described them, in the self-referent condition, a familiar other, in the other-referent condition, or they were asked about the case of the target word (e.g if the word was capitalised). Greater activity was observed within the mPFC region and the posterior cingulate following judgements about the self and a familiar other. Interestingly, the researchers witnessed that a distinct region of the mPFC was selectively engaged during self-referential judgement. This increased activity was also correlated with a memory

advantage for self-related items, indicating neural evidence for a self-network. In line with neural studies on self-referential processing, Humphreys and Sui (2016) proposed that the vmPFC is responsible for delivering information which is of self-relevance to the LpSTS region. It is argued that the vmPFC is rapidly activated in the presence of self-related stimuli which consequently activate the posterior superior temporal sulcus so that it is primed to react to self-related items. As a result, this activity promotes egotistic biases.

There is a rich and extensive account of research regarding the development of attention (see Colombo, 2001 for review) however, little is known about the development of attentional biases within children. During early and middle infancy, attention allocation is involuntary and driven in response to exogenous factors (Ruff & Rothbart, 1996) meaning that salient events in the environment guide attention. However, around six months of age, attention slowly begins to become more voluntary and affected by endogenous factors (Csibra, Tucker & Johnson, 2001). Endogenous attention can be referred to the ability to allocate attention to one stimulus whilst being able to ignore the other (Posner, 1980). Additionally, the ability to engage attention over a short period of time is defined as sustained attention (Parasuraman, 1986) and it has been stressed that sustained, rather than casual, attention is the ability to actively engage with and focus on an item or task (Ruff & Rothbart, 1996). This cognitive ability develops around 18 months of age (Ruff & Lawson, 1990). Interestingly, this development in attention co-occurs with mirror self-recognition at 18 months (Amsterdam, 1972), which further encourages the exploration of the self and its impact on attention. Clearly, research has extensively examined development of attention from infancy, yet there is a lack of knowledge regarding self-biases in attention among children. Additionally, research has found variabilities and impairments in sustained attention ability within ADHD (Barkley, 1997) providing another unclear picture of self-

processes within this clinical group and the extent to which the self may play a role on their cognition. The present study will aim to reduce this gap in literature, by trying to gain a better understanding of self-processes and the influence this has on typically developing and ADHD children's attention and memory both within a laboratory and classroom setting.

1.2 The self and memory

Despite the growing literature on self and the impact it has on cognition in adulthood, there is a poor understanding and lack of research on the influence of self on children's cognition. This is surprising as there is an awareness of the developing self-concept in early childhood, yet the function of the self and impact this can have on children's memory and attention has not been fully explored. Recent studies have aimed to rectify this gap in literature using a method called the self-reference effect (SRE). As discussed in section 1.1, attention is captured better for self-relevant items and leads to better success in information retrieval from memory. Thus, memory for information that has self-relevance is better recalled than information that holds less personal significance. This is the SRE and was first proposed by Rogers et al. (1977). Their study was an extension of the depth of processing study by Craik and Tulving (1975). Craik and Tulving (1975) examined whether different levels of information processing would influence participants' ability to recall information. In this research, participants were presented with a list of words, and each was followed by a question that required a yes or no answer. The questions were manipulated to alter the level of processing: shallow, moderate, or deep. Questions involving structural analysis, by asking if the word was capitalised, were used to instigate shallow processing. For moderate level of processing, phonemic features of the word were examined by asking participants if the presented words rhymed. Lastly, deep level of processing was activated by asking participants whether the target word belonged in the context of the presented phrase.

Following this, the next stage of the experiment involved a surprise recognition task in which participants were presented with a range of words and were asked to identify which of the words they had formerly been presented with and which were distractor words. Craik and Tulving (1975) discovered words which were processed at a deeper level (semantically) were recalled significantly better.

Rogers et al. (1977) hypothesised that self-relevant information would be processed at an even deeper level than semantic encoding. They replicated Craik and Tulving's (1975) study, with an additional task involving self-referent encoding. This involved asking adult participants if the target word described them. Interestingly, the study found that when a word had been processed in the self-referent condition, recall for the same target words were more significant than when processed structurally or semantically. These results indicated that information in our memory is hierarchical, with memory that has self-relevance being most prominent. The SRE may take place because attention for self-related information is captured which as a result improves memory for that information (Turk et al, 2008). Secondly, the effect occurs because the self is a rich and frequently used construct in memory. Autobiographical knowledge accrues in long-term memory and provides a prolific framework of self-related knowledge, in which newly learned self-related stimuli is easily absorbed, organised, stored, and enhanced (Klein & Loftus, 1988; Symons & Johnson, 1997).

Regarding SRE in childhood, there are a limited number of studies that have researched this area. As previously discussed, there is general agreement that children develop a basic self-concept within early childhood (Amsterdam, 1972; Lewis, 1990, 2003). The emergence of a self-concept is important for forming autobiographical memories (Howe & Courage, 1993). The development of a self-memory system would support the SRE because a well-developed and regularly utilised self-construct in memory supports the

organisation and storage of self-related information (Symons & Johnson, 1997). Consequently, as our self-concept develops so would the level of impact of self-referential processing.

A small number of studies have applied SRE paradigms among children. Early studies focused on middle childhood, concluding that the SRE manifests from 7 (Pullyblank, Bisanz, Scott, & Champion, 1985) to ten years of age (Halpin et al., 1984; Ray et al., 2009). Pullyblank et al. (1985) recruited participants from seven to eleven years of age for their study to assess self-related knowledge on recall among children. The researchers aimed to replicate findings by Rogers et al. (1977). Participants were presented with targets words which were encoded semantically, by asking questions about the meaning of the word, or self-referentially, by asking if the word described the participant. Notably, children as young as seven showed a memory advantage for self-referentially processed items. However, as pointed out by the researchers, the methods used were limited as they could not be applied to a younger age group. The paradigms were comparable to those used in studies involving adults, with the use of trait adjectives. Typically, children were asked to evaluate adjectives and make judgements. This would not be suitable for younger children as vocabulary is limited in early childhood and while children's thinking during early childhood is concrete (Hart & Damon, 1988) the tasks relies on abstract thinking. Consequently, an age- appropriate paradigm would be a better measure to pinpoint the onset of the SRE. Interestingly, a later study (Bennett & Sani, 2008) revealed that the SRE is evident from five years of age. Within this study, 360 children from five to ten years of age were recruited. The researchers found that memory for adjectives processed self-referentially was better than items within the control conditions, which included judgements made in relation to others as well as a semantic condition which asked questions regarding the meaning of the

target word. Overall, the results from SRE studies yield interesting findings, but provide an unclear understanding of the onset of the SRE in childhood.

Another supporting study (Sui & Zhu, 2005) aimed to simplify typical SRE methodology by avoiding complex trait adjective judgements which may potentially mask any SREs. The authors tested four, five and ten-year-old children and presented the participants with pictures of items displayed beside either a photo of their own face on a figure or an unfamiliar child's photo on a figure. The figure pointed to a picture of the target object and children were asked to indicate who was pointing, thus explicitly creating an association between the self and the object. Next, all age groups completed a recall test. Remarkably, children as young as five years old recalled significantly more items associated with the self, supporting the findings by Bennett and Sani (2008). However, four-year-old children showed a non-significant trend towards a memory advantage for items processed in relation to an other referent, providing a somewhat unclear picture of the SRE in early childhood.

To better the understanding of self-processing in early childhood, Ross, Anderson and Campbell (2011) conducted a range of experiments that aimed to examine the SRE using more age-appropriate measures. Within Experiment 1, the researchers tested a 'physical' SRE using the Self-Performed Action Task (SPT), which aimed to examine whether actions preschool children had performed themselves, as opposed to just watching the experimenter perform the action, would be better recalled during a recognition test. In this study, three and four-year-old children were recruited for the tasks. Two sets of 18 cards, including two practice ones, were used and each portrayed a female or male character performing a specific action, such as clapping hands. One of the character's names was always matched to that of the participant. The female

character was matched to female participants and the male to all male participants. Half of the actions were then acted out by the experimenter and half by the child. One week later, cards displaying the character depicting four similar actions were presented one at a time. In each there was an inclusion of the action that was encoded the previous week. Children were asked to try and remember which out of the four actions were acted out. Interestingly, children significantly recalled actions that were related to them both cognitively, as a result of name and gender matching, and physically through the enactment of the depicted action. The researchers discussed the potential importance of the SPT in contributing to the development of autobiographical memories. However, as pointed by the authors, one of the shortcomings of the experimental design was that explicit references to the self were not made, thus it cannot be concluded from these findings whether preschool children can recall memories directly linked to themselves. Inclusion of source memory tests would address this limitation, and the present study aims to rectify this limitation by including unaided free recall to measure episodic recollection.

Within Experiment 2 and 3, Ross et al. (2011) replaced physical encoding from Experiment 1 with visual-cognitive encoding tasks. Rather than using generic figures, as utilised by Sui and Zhu (2005), a full portrait of the child and other-referent was used to point to target objects to prevent any uncertainty of the self and other distinction. In the study by Sui and Zhu (2005), four-year-old children showed a non-significant trend towards an other-referent effect. Ross et al. (2011) witnessed a similar effect among four-year olds, yet in their study the difference was statistically significant. Three-year-old participants did not show any SRE. Nevertheless, the difference in self and other-item recall, despite it being in the direction of an other-referent effect, revealed that children as young as four can

distinguish between the self and other. The authors proposed that a failed SRE may have been due to methodological reasons. By locating the referent's photograph in a different visual field from the to-be-remembered stimuli, this may influence the encoding of self-paired objects. This is because interest in one's own picture may draw attention away from the paired item. To meet this limitation, Ross et al. (2011) placed the item's picture on top of the referent's photo within Experiment 3, so that it appeared as though the referent was holding the object. Interestingly, their study was the first to demonstrate that children as young as 3 display a memory advantage for self-items. In the last set of experiments, a cognitive rather than visual link was created between self and other-items using an ownership paradigm. To self-referentially encode an item, the object was manipulated to be either 'mine' or 'yours'. As discussed in chapter 1, children begin to use personal pronouns by the age of two which are indicative of self-development (Lewis, 1990). Ross et al. (2011) found that children as young as three and a half showed a bias for stimuli that had been associated with the self socio-cognitively through ownership. Overall, these experiments provided an insight into the onset of the SRE, revealing that the self can impact cognitive functions at a younger age than originally suspected. By using methodology which could be applied to younger children, the study was the first to reveal SREs within preschool children.

Additional studies which have examined a cognitive SRE in early childhood using age-appropriate concrete encoding have also found the SRE to be robust at a young age (Cunningham, Brebner, Quinn & Turk, 2014). Within a study by Cunningham et al. (2014), four to six-year-old children were recruited. In the first of the three experiments, children were presented with a picture of themselves in the self-reference trials and an unfamiliar child's picture in the other-referent trial alongside an image of a familiar item, such a toy. Children were instructed to report, by selecting a positive or neutral face, whether they

thought the person shown would like the object or not. Following this, they were presented with a recognition task in which all items from the task as well as distractor items were individually displayed. Participants were asked to simply indicate whether the object was new or old, and to guess if they were not sure. Interestingly, there was better recall for objects which were processed in the self-reference condition which showed that even young children benefited from a memory advantage when the SRE was applied.

In Experiment 2, both tasks from Experiment 1 were replicated, however, between the SRE task and recognition test was a 5-minute delay with the use of a digit span test to avoid ceiling effects. Moreover, in the recognition test, to test source memory, participants were asked to report whether the object displayed was new, shown with their picture or shown with the other-referent. Similar to Experiment 1, items from the self-referent condition were more likely to be recalled than in the other-referent condition. Source memory in the self-referent condition was also significantly higher than the other-referent condition. This study suggests that the SRE is robust during early childhood, and even simple concrete associations with the self are advantageous. Traditional paradigms could not be applied in early childhood, thus explaining why most self-referencing studies were utilised within populations that were at a reading age. However, it is it unclear whether the various SRE tasks that have been used in early childhood are measuring the same bias, as they have not been compared within subjects. This comparison is one aim of the current thesis. By understanding the development of self-concept and self-memory systems in childhood, the potential to apply the SRE to real-world contexts is made more possible. Specifically, knowledge of the self-system among children can aid the development of effective self-referential educational interventions which could support children's attention and memory within learning.

1.3 The educational applications of the self-reference effect

Recent studies have revealed the efficacy of utilising the SRE as an educational intervention. As discussed in section 1.2, self-related stimuli can capture attention as well as facilitate sustained attention on the task (hereby referred to as engagement), thus resulting in a memory advantage. Both engagement and memory are undoubtedly important for effective learning, and many approaches have been developed and recommended to maintain engagement among students. For example, it has been suggested that incorporating concrete materials in teaching are important to increase attention and interest (Sadoski et al., 1993) as well as familiarity (Bransford & Johnson, 1972). Indeed, self-referential stimuli are inevitably familiar. Intriguingly, it has been suggested that student's difficulties in mathematics can be addressed by personalising questions. This is because some of the factors which can affect performance are low or no motivation (Hart, 1996) and importantly, a lack of personal connection and relevance in questions (Ensign, 1997). It was suggested that integrating one's personal experiences from outwith the school is important because there seems to be a gap between the child's personal life and school experience. This disconnectedness is a concern as it means children are not transferring skills from school to their external experiences and vice versa.

Davis-Dorsey, Ross, and Morrison (1991) conducted a study in which students were presented with math problems. Questions were manipulated to include self-relevant stimuli such as a protagonist that the participant knew (such as a best friend) in place of names that were used in the original mathematic question. They also included participants' interests in place of the examples used from the textbook derived questions. As well as personalisation, the authors also examined whether rewording of questions to make them more explicit would be beneficial. Interestingly, Davis-Dorsey et al. (1991) found that

personalisation was an effective learning method and argued that it helped in representing problems mentally and made questions more relatable as well as concrete. In their study, fifth graders benefited from personalisation alone, but second graders needed both a combination of rewording and personalisation. However, this again could be due to the task being too complex thus underestimating younger children's abilities. Moreover, the tasks did not include pronouns or any methods to relate questions to the individual directly (self-referencing) and doing so may be more effective.

An example of a math study that does employ the use of personal pronouns in questions is by d'Ailly, Simpson, and MacKinnon (1997). In this study, students from primary three, four and five were recruited. In half of the textbook derived questions, protagonists were replaced with the word 'you' and half were left in their original format. Interestingly, it was found that children asked for less clarifications and answered questions faster and more accurately in the personalised condition, suggesting that personalisation lead to better attention which subsequently improved math performance. In an additional study, the self-referential approach was applied in literacy tasks among seven to nine-year olds. Turk, Gillespie-Smith, Krigolson, Havard, Conway and Cunningham (2015) conducted an experiment based on the 'See it, Say it, Cover it, Write it, Check it and Write a Sentence' method which involves copying down words that are to be remembered and incorporating them into a sentence. In experiment 1 of the study, the researchers created four cartoon alien characters with nonsense words allocated as names. This was to prevent the chances of existing knowledge from affecting performance. A picture of each alien and their name was presented and participants were asked to copy it down twice. They were then asked to generate a sentence including the alien and either themselves, in the self-referent condition, and with another referent alien in the other-referent condition. Sentence lengths

and quality were used to examine level of engagement. Following this, the experimenter clearly read out the name of each of the aliens and participants were instructed to write the name down whilst ensuring to focus on the spelling. Spelling accuracy was then assessed by measuring the level of accuracy of each alien name, and engagement was assessed by calculating the length of sentence in words. As the researchers had predicted, both spelling accuracy and engagement was significantly higher in the self-referencing condition. This finding suggests that attention and memory may have produced the effect, in which attention for self-referential encoded material was better and consequently resulted in greater memory recall.

In Experiment 2, a standard school spelling test was used to test the effectiveness of using self-referencing as a teaching strategy. The class teacher provided a list of words appropriate for the child's abilities. These new words were presented to the child by the experimenter and children were asked to copy the word three times. This time, instead of the other-referent being a novel alien name the researchers chose to use a familiar, non-intimate protagonist. Following this, just like in experiment 1, they were asked to generate a sentence including themselves or the other-referent. Again, a spelling test was administered. Similar to Experiment 1, there was a greater level of spelling accuracy and engagement following encoding in the self-referent condition, suggesting that the SRE can be utilised as an effective tool for learning.

In light of these findings, future research should aim to look at applying the attention and memory effects to other educational issues. In particular, there has been a lack of research concerning the SRE and its potential educational benefits among children within clinical populations. For example, if the SRE is dependent on attention then it may operate differently in children whose attention is compromised, such as those with Attention Deficit

Hyperactivity Disorder (ADHD). The present study will aim to better understand the SRE within ADHD. The effectiveness of using the SRE as an educational tool to promote engagement and memory among typically developing children and children with ADHD will also be explored.

1.4 Applying the self-reference effect in ADHD

ADHD is a neurological disorder, affecting 5.5% of children world-wide. This prevalence figure was revealed in a study by Polanczyk, Lima, Horta, Biederman and Rohde (2007) in which the authors conducted a review of 102 studies accumulating a total of 171, 756 children around the world. Such a high prevalence rate stresses the importance of increasing our understanding of any existing differences in cognition with the clinical group. ADHD is characterised by persistent patterns of inattention and/or hyperactivity/impulsivity which can result in impairments within various areas such a socially and academically. In a study by Klein, Gangi and Lax (2011) the self and memory were assessed using the self-referencing paradigm from Rogers et al.'s (1977) study. In Experiment 1, the researchers recruited young adults (18 to 22-year-old) with and without ADHD. Interestingly, results for both the ADHD group and the control were comparable, as recall for words self-referentially encoded were significantly better than words encoded semantically and structurally. Moreover, during recall, when participants were asked to try and make a list of words they could remember, they were asked to note down each word on a new line. Unknown to them, this was to analyse recall order. Both the ADHD and control group performed well.

In their second experiment, rather than simply asking whether descriptive words described them participants instead were asked if they could, using the target word, describe a memory in which they behaved in a manner implied by the word. This was to

encourage the retrieval of episodic self-knowledge rather than semantic self-knowledge. The researchers found, again, words encoded self-referentially were recalled better than words encoded structurally and semantically in both groups. However, the control group outperformed the ADHD group in word recall following self-referential encoding. The researchers concluded that these results are in line with previous findings, which have suggested that access to trait self-knowledge is intact (as shown in study 1) but the psychological self is defective, like in other disorders including Autism Spectrum Disorder, amnesia and dementia (Klein & Laz, 2010). This is in line with the argument that our self- concept is encompassed of two parts, the 'I' (i.e. existential self), and the 'me' (i.e. categorical self) as discussed in chapter 1 section 1. However, it may be the case that among ADHD participants, difficulties may be due to attentional reasons, in which the demanding task of both understanding concepts as well as trying to retrieve appropriate memories may be overworking attentional capacity. In addition, in Experiment 2 of Klein et al.'s (2011) study, scrutiny of data analysis revealed that the main effect of group was only 'marginally reliable'. Thus, it is plausible to argue that participants with ADHD may benefit from self- referencing strategies even when measures of episodic memories are incorporated. Due to better than chance performance following self-referential encoding in study 1, as well as excellent organisational evidence of recall, it would be useful to use stricter methodology and measures of attention to better understand and explore the self in ADHD.

1.5 Present study

The self-construct and its influence on cognitive functions are extensively researched and well understood within adults, yet is under-researched among children. Consequently, we do not yet have a full understanding of the developmental course of the self-construct or

the impact that it has on cognition. Furthermore, no research has assessed whether children with ADHD show basic SREs and whether their self-system is comparable to typically developing children. Finally, there is also limited research on the educational applications of the SRE within typically developing groups, and no research within ADHD. The present study aims to address these gaps in the literature. Within Experiment 1, the study will firstly aim to conduct an examination of self-referential biases in typically developing primary school aged children. Next, the research aims to test the efficacy of a self-referent educational intervention. In Experiment 2, self-referential processes will be examined within an ADHD sample as well as comparing performance with a typically developing group matched on verbal age, chronological age, performance IQ and sex. Additionally, self-referencing as an educational engagement tool will be evaluated. Due to difficulties that the ADHD clinical group faces with attention and memory, the study will evaluate the effectiveness of the SRE as a tool for increasing engagement and improving memory in the classroom. An encoding task, derived from Cunningham et al. (2014) and the SPT (Ross et al., 2011) will be used to measure memory. To explore the educational applications of the SRE, an adapted task derived from Turk et al. (2015) will be administered. Additional measures involve assessing verbal and nonverbal abilities and assessing attentional capacities. These variables' relationship with egotistic biases will be examined. Overall, these measures aim to provide a systematic examination of the SRE and its potential educational applications.

Experiment 1: exploring the self-reference effect and its efficacy as an educational tool in typically developing children

The purpose of Experiment 1 is to firstly examine physical and cognitive self-referential biases within children. Secondly, the aim is to use an adapted spelling task (Turk et al., 2015) to assess the SRE in typically developing children within an educational setting. It is hypothesised that following self-referential processing there will be greater memory for self-processed items and self-performed actions. In the educational task, it is predicted that there will be longer sentence production, greater spelling accuracy, and better recall of alien description within the self-referent group. Sentence length will be used to assess engagement, and spelling accuracy and recall of alien features will be used as a measure of memory. Alien description recall will be used to assess whether distinct character features will be processed and remembered better following self-referential encoding. It is predicted that the magnitude of the SRE within the evaluative self-referencing task will be positively correlated with the SRE magnitude in the SPT. Moreover, it is hypothesised that a greater SRE within the self- referential encoding tasks will be related to better memory and attention following self- referential encoding in the spelling task. Lastly, the relationship between the self-referential processing tasks and attention will be examined. If attention drives self-bias, then it is predicted that children with better attentional capacity will be more influenced by self- referencing processes.

Method

2.1.2 Participants

A pack which included an information sheet and consent form (see Appendix B) was sent to parents of children from a local primary school along with a prepaid envelope. Children with parental consent were included in the study and the research was reviewed and approved by Dundee City Council and Abertay University's School of Social and Health Sciences Research Ethics Committee (see Appendix A). A total of 33 children (16 female, 17 male), ranging in age from five years to twelve years (*M* = 8.60, *SD* = 1.82) participated.

2.1.3 Design

The self-referential encoding tasks, attentional capacity measures, and verbal and nonverbal tasks were a within-subjects design, in which all participants took part in the same tasks. The educational task was a between-subjects design. The independent variable was Referent (self or other). Participants were randomly allocated to the self or other conditions.

2.1.4 Stimuli and procedure

2.1.5 Educational task

The experimenter met the child on three occasions separated roughly one to two weeks apart. During session one, children completed a spelling task, adapted from Turk et al. (2015). This task involved using four two syllable nonsense words presented as names of green aliens (Arror, Genful, Winead & Swarty). For a neutral other–referent a red alien named Splay was also included (see Figure 1). Novel names were used to decrease the effects of prior knowledge on performance. Pictures of the aliens were presented on a worksheet, and participants were asked to copy down the four names twice. After, the participants were asked to produce sentences regarding each alien. Participants in the self-

referent condition were asked to write what they and each alien might do if they were going to spend the day together. The other-referent condition was instructed to do the same, except to write about what each alien and Splay would do together for a day.

After this, a photograph of the child was taken with a digital camera for use as a self-referencing cue in the SRE task within session two. This also served as a filler task to decrease the chance of ceiling effects within the spelling task. The photograph was resized to 250 by 250 pixels (72 dpi) using Microsoft paint and was cropped onto a white background and saved in bitmap format. Following the photograph, each alien name was read out by the experimenter and participants were asked to try and remember how to spell each alien name. Additionally, they were asked to note down any information about the alien that they could remember (such as Arror had armbands on) as a further test of recall.

Figure 1. The figure illustrates the other-referent (Splay) and the four two syllable nonsense words portrayed as alien names (Genful, Winead, Arror and Swarty).

2.1.6 Self-referential encoding tasks

During session two children completed the evaluative self-referencing task (Cunningham et al., 2014). This is a ten-minute computer-based task in which children are presented with 48 images of objects in a self-referent (own face) or other-referent (child named 'Sam') context (see figure 2). The objects were derived from a complete set of 72 items, which were divided into three lists. One list was administered in the self-reference trials, one in the

other-referent trials and the remaining was used as foils for the memory test. The lists were counterbalanced across subjects. The other-referent was gender matched, in which female participants were presented with a girl named Sam, and males were shown a boy named Sam. The other-referent was unknown to the participants. A face was displayed on the centre of the screen alongside a picture of a familiar item such as a toy or household item. On half the trials, items were presented beside the child's face and the other half were displayed alongside the other-referent's face. There was a total of 24 self-referent and 24 other-referent trials which were randomly presented. By pressing either a smiley face or neutral face on the touch-screen laptop, participants were asked to indicate whether they thought the person displayed beside the object would or would not like the item. Before the experimental trials began, children completed a practice trial to ensure that they understood the instructions and could evaluate their or Sam's feelings towards the object depicted. All children completed the practice trials successfully and were asked to focus on the laptop screen so that they did not accidentally miss any object.

A one-step memory test was used to assess source memory for the images, in which pictures of objects along with new foil images were displayed one at a time to the participant. Children were instructed to indicate whether the picture was new, previously displayed beside their face or by Sam's face. This was completed by pressing the corresponding buttons on the keyboard, labelled as 'me' 'new' and 'Sam'. If children were not sure of the answer, they were encouraged to try and guess.

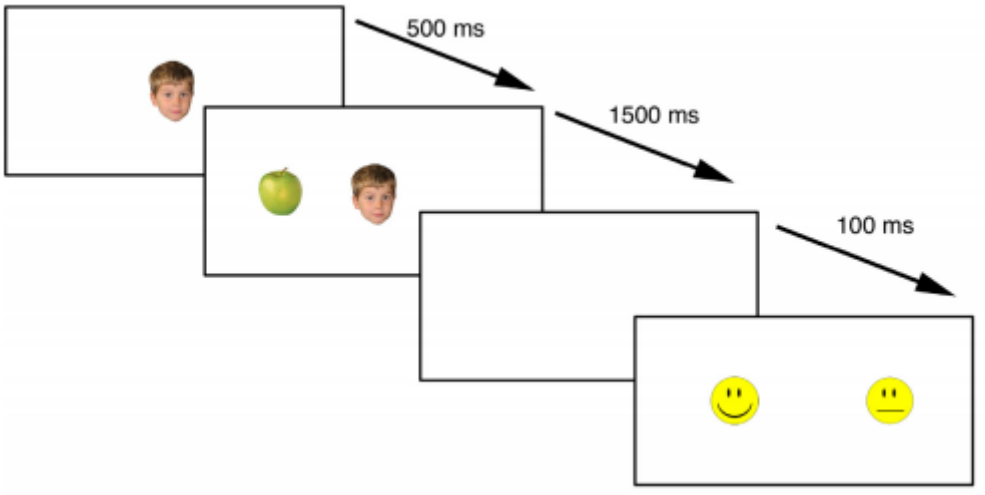

Figure 2. Example trial in the evaluative self-referencing task.

Next, the Self-Performed Action Task (SPT; Ross et al., 2011) was administered (see Figure 3). Participants were introduced to characters called the "wugs" using a neutral template of the character. Twenty-four cards were then presented one at a time to the child, in which each depicted an action by the wug, such as dancing. Half of the actions were performed by the participant and half by the experimenter, and this was counterbalanced. Counterbalancing was completed by asking participants with an odd participant number to begin the task by coping the first depicted action. When testing participants with an even number, the experimenter started the trials by acting out the first action. This ensured that all actions were equally presented to both the experimenter and participants. Recall and source memory for the images were then tested following two subtests from the Tests of Everyday Attention for Children (TEA-Ch; Manly, Robertson, Anderson, & Nimmo-Smith, 1999). To test recall children were presented with the neutral wug and asked whether they could remember any of the actions which were performed.

Figure 2. Examples of actions (hammering, dancing) depicted by the 'wug' within the Self-Performed Action Task.

2.1.7 Attentional capacity measures

To provide a measure of attentional capacity, children completed two tasks from the TEA-Ch. There was a one-minute sustained attention task called 'Map Mission' in which participants were presented with a target map symbol and then asked to find and circle as many of the symbols on a map that they could. The map was provided to the participant within a plastic wallet which they could write on using a black marker. The number of correct symbols identified was recorded and the circles were immediately wiped off. The next task, named Opposite Worlds, involved testing attentional control and inhibition. A path of digits made of '1' and '2' were displayed from a start and stop point. There were four trials in total, two 'Same Worlds' and two 'Opposite Worlds'. Children were asked to begin on 'start' and read out each number till the end of the path. In Same World, numbers were read out as they were written. For Opposite World, children were instructed to say '2' when they read '1' and vice versa. The speed at which children reached the end was recorded. Raw scores from the subtests were converted to scaled scores, taking into account the participants' age and sex. The scaled scores ranged from 1 to 19, with a mean of 10 and standard deviation of 3.

2.1.8 Verbal and nonverbal intelligence measures

In session three, the Block Design subtest of the Wechsler Intelligence Scale for Children–

Fourth Edition (WISC–IV; Wechsler, 2003) was used to test nonverbal intelligence. The test is a measure of visuospatial and organisational processing abilities. The Block Design test was used to compute a performance IQ score. The British Picture Vocabulary Scale (BPVSIII; Dunn, Dunn, Styles & Sewell, 2009) was administered to assess children's vocabulary. The test was designed to evaluate children's receptive vocabulary as well as identify any delays in vocabulary development. The test produces a percentile rank score as well as a verbal age score.

Results

2.2.1 Evaluative self-referencing task

For all ANOVAs, a partial eta squared (ηp^2) provides a measure of effect size. This value can be interpreted following Cohen (1969) suggestion that an effect size of 0.2 is small, 0.5 is medium and 0.8 is large. For all statistical tests, a confidence level of 95% was used. Source memory scores were corrected for guessing by taking false alarm rates into consideration. Proportion of false alarm rates for self (new items incorrectly identified as shown with their own photo) was detracted from the proportion of self-items correctly identified as being presented alongside the self. Next, proportion of false alarm rates for other (new items mistakenly identified as shown with the other-referent) was subtracted from the proportion of other-items accurately identified as presented beside the other-referent. To test memory for self and other items, a within-subjects ANOVA was used (see Table 1 for means).

Table 1: Mean evaluative self-referencing task scores

	Proportionate source memory scores	Corrected Source memory scores
Self-items	.76	.70
Other-items	.67	.63

There was a significant difference between source memory for self and other items; $F(1, 32) = 8.21$, $p = .007$, $\eta p^2 = .20$. Individual differences were examined to explore whether any factors contributed to the self-source memory advantage. A self-referential encoding advantage score was calculated by subtracting other source memory scores from the self source memory scores. Next, correlational analyses were conducted to examine whether chronological age, verbal age (BPVS), performance IQ, or attentional scores predicted the self-referent source advantage (see Table 2). It was predicted that only attentional scores would have an impact.

Table 2: Correlation coefficients and the corresponding p values (in brackets) for the relationship between age in months, verbal age (BPVS score), performance IQ, attentional score (TEA-Ch), the self-referent source memory advantage score and SPT memory advantage score.

	BPVS score	Performance IQ	Attentional score	Self-referent source memory advantage score	SPT self memory advantage score
Age (in months)	.84 ***(.00***)	-.19 (.30)	.26 (.14)	.16 (.36)	-.03 (.85)
BPVS score		-.07 (.71)	.31 (.08)	.32 ***(.04)***	.04 (.81)
Performance IQ			.45 ***(.01)***	.00 (.99)	.28 (.12)
Attentional score				.07 (.70)	.27 (.13)
Self-referent source memory score advantage					.16 (.38)

2.2.2 Self-performed action task

Scoring was completed by totalling the correct number of actions recalled which participants had performed themselves and for actions performed by the experimenter. After, the difference between recall scores for self and other actions were calculated. A within-subjects ANOVA was conducted to compare recall for self and other performed actions in the SPT. There was a significant difference in the scores for self-performed actions (M=.60, SD=.14) and other-performed actions (M= .40, SD=.14) recall; $F(1, 32) = 17.29$, $p < .001$, $\eta p^2 = .35$, revealing better recall for self-items. Individual differences were explored to measure the relationship between chronological age, verbal age, performance IQ, attentional ability, evaluative task self source memory scores and the SPT memory advantage scores.

The self- performed memory advantage score was calculated by subtracting memory scores for other-performed actions from memory scores for self-performed actions (see Table 2 for correlation coefficients). The correlational analysis yielded no significant results, suggesting that chronological age, verbal age, attentional scores, and performance IQ did not impact children's ability to encode and recall self-performed actions. Additionally, there was no relationship between the physical and cognitive SRE tasks.

2.2.3 Educational task

Copying accuracy was recorded for each alien name during the 'See it, Say it, Cover it, Write it, Check it' exercise. Spelling accuracy, length of sentence and description recall was also measured. For scoring, the proportion of letters correct was calculated. For example, if the target word was five letters long and was spelled accurately then a score of 1 was received. If the child spelt much of the word correct with the exclusion of the last, then a score of

0.80 was received. Similarly, if three out of five letters, in their correct location, were correctly recalled then a score of 0.60 was given. This marking strategy was repeated for all letters accurately recalled in their exact location. For sentence length, the number of words in the sentence were recorded for each of the four sentences, and then an overall mean score was calculated. To measure description recall, any distinct features which the participant recalled, such as that Winead was holding a beaker, was given a score of one. The total scores for each of the four aliens were then used to calculate a mean score.

Sentence length was used to measure engagement, and spelling accuracy and description recall was used to measure encoding and retrieval. Copying accuracy in the spelling test was high (99%) therefore all participants were included for subsequent analysis. Inspection of data using the Shapiro-Wilk test revealed that the data for self and other-referent conditions were non-normal for spelling accuracy. Therefore, a non-parametric test was used. A Mann-Whitney test was used to analyse differences in alien spelling accuracy between the self (M=17.25) and other-referent (M=16.76) conditions. There was no statistically significant difference, $U(31)$, Z = -.16, p = .90 between the groups. To test for differences in sentence length production as a measure of engagement, a between-subjects t-test was used to analyse differences between the self-referent (M = 8.22, SD = 2.23) and other-referent (M=7.15, SD = 2.09) conditions. There was no statistically significant difference, $t(31)$ = 1.43, p = .16. Analysis of differences in description recall between self-referent (M= 2.17, SD = 1.55) and other-referent (M=2.49, SD = 1.91) groups yielded no significant difference, $t(31)$, -.52, p = .61.

Discussion

Experiment 1 explored physical and evaluative self-referential encoding within a typically developing sample. Additionally, a spelling task adapted from Turk et al. (2015) was utilised to examine whether engagement and memory would be improved following self-referential encoding. There was a bias for source memory related to the self within the evaluative self-referencing paradigm. These findings are consistent with Cunningham et al. (2014) in which source memory within the evaluative self-referencing task was higher for self-items than other-items. In the present study, children's verbal age was significantly correlated with the source memory advantage score. This is unsurprising, as previous research has indicated that various mechanisms underlie source memory. It has been found that children's ability to correctly identify the contextual information of an item is strongly predicted by executive functioning skills (Rajan & Bell, 2015; Glisky, Polster & Routhieaux, 1995). However, in the study by Cunningham et al. (2014) verbal ability did not predict source memory advantage. This revealed that unlike previous research in which the ability to bind information and source memory progresses with age and mental ability (Lloyd, Doydum & Newcombe, 2009), source memory for self benefited children of different ages and capability. Within the present study, despite the wide age range, age did not influence performance either but verbal ability did, perhaps because verbal age provides a better indication of the child's developmental progress. Interestingly, attentional capacity did not predict the SRE. This finding perhaps further stresses the importance of attention and the impact it has on memory. Previous research has suggested that attention may be the driving mechanism that produces the self-bias effect (Humphreys & Sui, 2016). In the present study, an increase in attentional capacity did not correlate with the SRE magnitude, suggesting that self-referential processes facilitate attention and allow individuals of varying attentional

capacities to benefit from self-encoding.

Within the SPT, recall for actions performed by self was better than actions performed by the experimenter. This suggests that actions which have been performed by the self, rather than just observed, are stored, encoded, and remembered more easily. The findings replicate those found by Ross et al. (2011) in which a memory advantage was observed for self-performed actions. However, as the present study involved unaided free recall, children demonstrated explicit recall to memories linked to the self. A mnemonic advantage for self-performed actions has been associated with multimodal encoding, including the processing of the verbal and semantic context of the performed action (Bäckman & Nilsson, 1985), arguing that a memory advantage within the SPT occurs due to the encoding of the action's visual-semantic information coupled with perceptual cues, as well as the corresponding motor movements (Bäckman, 1985).

If this level of processing is involved within the SPT, a positive correlation for the SRE between both the SPT and evaluative self-referencing task would be expected as the evaluative task also involves the encoding of contextual information. However, in the present study, there was no relationship between the SRE magnitudes within the two self-referential processing tasks. A better explanation therefore might be that the physical and cognitive tasks tap into different functions of the self-system (see chapter 1, section 1). This is supported by evidence which revealed that the SRE was evident following self-performed actions even when participants were blindfolded, eliminating any visual contextual information during encoding (Engelkamp, Zimmer, & Biegelmann, 1993; Mulligan & Hornstein, 2003). Accordingly, the nature of the physical, rather than psychological, self (Lind, 2010) which involves low level, automatic response to self-processed information may be the mechanism involved in the memory advantage following self-performed

actions. Consequently, this may be an indicator of a typical developing physical self-concept in childhood.

In the present study, verbal ability did not impact the self memory advantage within the SPT. This has several implications. Firstly, it potentially supports the idea that the SRE is a powerful encoding tool which benefits children of differing ages and abilities (Cunningham et al., 2014). This is in line with previous literature, in which it was demonstrated that the mechanisms involved in self-referential processes are linked to distinct neurological activation (Sui, He & Humphreys, 2012; Amodio & Frith, 2006; Jenkens & Mitchell, 2011) as well as deeper encoding properties than semantic, structural and phonological processing (Rogers et al., 1977). Alternatively, as verbal ability predicted the SRE within the cognitive encoding task but not the SPT this may again be indicative that the tests tap into different levels of the self-system: the physical and psychological self. The latter is an objective and higher-order constituent of the self (Cunningham et al., 2014), and self- relevant information is encoded and easily stored using an existing rich body of self- knowledge (Symons & Johnson, 1997). Therefore, as the evaluative self-referencing task relies on more intricate information processing than the SPT, this may explain why verbal ability predicted the SRE magnitude within the cognitive self-referencing task. Alternatively, the cognitive task may be more suitable for verbal encoding, whereas the SPT is perhaps less verbalisable or requires more non-verbal resources during encoding. Together, both the SPT and evaluative task indicate that the self-construct plays a functionally important role on cognition within early childhood. By acquiring an understanding of the functional role of the self, the real-world implications of the SRE can be better explored.

Next, within Experiment 1, the applications of the SRE in a spelling task were examined. No differences in sentence length, spelling accuracy or recall of alien description were

observed between the self and other-referent conditions. These findings do not match those by Turk et al. (2015) in which self-referential encoding promoted engagement and positively impacted memory. However, in the present study, a non-parametric test was used, and a negative skewness in data reflected a ceiling effect suggesting the difficulty levels may have impacted the results. Moreover, inspections of means show that performance following self-referential processing was higher and infer a trend towards self-referential encoding. In Turk et al's (2015) sample, 47 participants from seven to nine years of age were recruited. As the present study included 34 participants from the ages of five to twelve, there may have been a lack of power and as the same test was used for all ages this may have contributed to the ceiling effect. It was hypothesised that the SRE magnitude within the SPT and evaluative self-referencing task would predict memory and attention following self-referential encoding in the education task. However, as there was no difference between the self and other-referential encoding groups, and a ceiling effect was observed, the prediction was not confirmed. As a result, further analysis should be carried out with additional participants and strict measures should be taken to avoid ceiling effects. As discussed in section 1.4, personalising questions has been associated with student engagement (Hart, 1996), even with the simple inclusion of pronouns (d'Ailly et al., 1997). By included pronouns in place of unknown protagonists in textbook derived questions, d'Ailly et al. (1997) observed learning success in which children performed faster, more accurately and asked for less assistance. A shortfall of the present study was perhaps the lack of use of age and ability matched exercises. Similar to Turk et al. (2015), in which a test using spelling words from the child's teacher was administered, textbook based questions would measure the applications of the SRE within a realistic school setting. Thus, the present study may have lacked ecological validity and the administration of a task that

underestimated performance may have contributed to the findings.

Overall, typically developing children revealed a self-bias in attention and memory helping to gain a better understanding of the self-construct and its influence on cognition within childhood. The educational applications of the SRE should be further explored as evidence from the self-referential encoding tasks (Cunningham et al., 2014) coupled with previous research on SRE educational interventions (Turk et al., 2015) offer a clear illustration of the potential for the SRE to support learning. Although not found in the present study, Turk et al. (2015) provided evidence that typically developing children benefited from self-referential educational interventions due to its impact on engagement and memory. It is therefore worthwhile to assess whether self-referencing methods may be particularly beneficial for clinical groups who face difficulties with these cognitive areas. Therefore, Experiment 2 aimed to examine the SRE in children with ADHD.

Experiment 2: Exploring the SRE and the testing the efficacy of self-reference as an educational engagement tool for supporting memory in ADHD groups.

It is theorised that two different mechanisms are involved in producing the SRE, which are consistent with the philosophical notion that the self is comprised of two concepts (see chapter 1, section 1), e.g. the 'I' (existential) self and the 'me' (objective) self (Lewis, 1990). Firstly, it is argued that self-cues drive attention which consequently improve memory for the processed information, relying on the aspect of self which is simply physical and low-level. The second cause of the SRE results from our rich self-knowledge framework in which new incoming self-related information can easily be added and stored, consequently supporting memory. This process relies on a higher-order, elaborative self-concept (Symons & Johnson, 1997, Turk et al., 2008; Ross et al., 2011; Humphreys & Sui, 2016). Accordingly, SREs can be used to assess the developing self-system and identify the emergence of

associated attentional biases in childhood (Ross et al., 2011). Therefore, the SRE could potentially improve our basic understanding of self-processes within children with ADHD and understand the extent to which self-referential processes may facilitate their attention and memory.

Previous research has revealed that ADHD adults show a similar recall advantage for self-processed items as a typically developing group (Klein et al., 2011). This finding highlights the potential for the SRE to function in ADHD children at a comparable level to a matched non-clinical control group. However, studies also discovered that adults showed deficits in their psychological, but not physical, self indicating that there may be an atypical development of the self-construct (Klein et al., 2011; Klein & Lax., 2010). These studies however involved methodology which may have masked potential differences (see section 1.4) and the present study aims to rectify this using more sensitive measures. As a limited number of studies have addressed the self-system among ADHD and no studies have explored the SRE in children with ADHD, the aim of Experiment 2 was to examine self-referential processes within children with ADHD and explore whether the clinical group benefits from a self-referent educational intervention. Children with ADHD will be compared with a subgroup of children tested in Experiment 1, and therefore the tasks utilised will be identical. It is hypothesised that an SRE will be found among children with ADHD following both the evaluative and self-performed task. It is also predicted that children with ADHD will show improved attention and memory following self-referential encoding in the spelling task. It is predicted that typically developing children will have better memory overall.

Method

3.1.1 Participants

An information sheet and consent form were sent to parents of children from an ADHD support group (see Appendix C). Children with parental consent were included in the study and the research was reviewed and approved by Abertay University's School of Social and Health Sciences Research Ethics Committee. A total of 16 participants (10 female, 6 male) were referred by the support group and participated in the study. One child was derived from the school data from Experiment 1, as they had a clinical diagnosis of ADHD. Participants ranged in age from 5 to 10 (*M* = 8.06, *SD* = 1.61). Data was compared to a sample of children from the typically developing group in Experiment 1, matched as closely as possible on chronological age, verbal age, performance IQ and sex (see Table 3). Due to absences, there were three missing verbal age scores and three incomplete performance IQ scores. One participant from the ADHD group was excluded from both self-reference encoding tasks, but not spelling task, due to incompletion of the tests.

Table 3: ADHD and typically developing (TD) group's chronological age, verbal age, performance IQ and attentional scores

	Chronological age (months)		Verbal Age		Performance IQ		Attentional Scores	
	ADHD	TD	ADHD	TD	ADHD	TD	ADHD	TD
Mean	103.31	103.31	83.85*	98.06*	46.46*	49.38*	8.45	9.48
Standard Deviation	19.46	18.67	17.35	19.46	3.60	3.63	2.34	2.44

*Statistically significant at $p<0.05$.

3.1.2 Stimuli, procedure, and design

The stimuli and procedure and design were the exact same as Experiment 1 for all three sessions, see section 2.1.3 for details. The experimental groups will be compared, therefore the variables are between-subjects.

Results

3.2.1 Evaluative self-referencing task

For all statistical tests, a confidence level of .05 was used. To analyse the scores for source memory, the same procedure from Experiment 1 was used (see section 2.1.1 for details). Table 4 illustrates uncorrected and corrected mean scores.

Table 4: Mean evaluative self-referencing task scores within the ADHD group and typically developing sample

	Source memory scores		Corrected source memory scores	
	ADHD	TD	ADHD	TD
Self-items	.51	.77	.34	.71
Other-items	.52	.68	.40	.63

Table 4 reveals that changes in source memory scores following correction were lowest for self-items within the ADHD group. This indicates that children within the clinical group were more likely to incorrectly remember seeing items beside their own face.

A mixed-design ANOVA was conducted to compare the main effects and interaction of experimental group and referent on source memory scores. Experimental group included two levels (typically developing, ADHD) and the within-subjects condition, referent, consisted of two levels (self, other). The main effect for experimental group yielded an F

ratio of $F(1, 29) = 7.15$, $p = .01$, $\eta p^2 = .20$, indicating a significant difference between the typically developing group ($M = .67$, $SD = .08$) and the ADHD group ($M = .37$, $SD = .08$; see figure 3). The main effect for referent produced an F ratio of $F(1, 29) = .05$, $p = .83$, $\eta p^2 = .002$, indicating no significant difference between self ($M = .53$, $SD = .07$) and other ($M = .52$, $SD = .05$) source memory scores. The interaction was not statistically significant, $F(1, 29) =$, 3.42, $p = .08$, $\eta p^2 = .11$. As the interaction was close to significance, repeated measures ANOVAS were carried out to examine differences in self and other source memory within both groups. There was a significant difference between self (M = .71, SD = .6) and other (.63, SD = .26) source memory within the typically developing group, $F(1, 15) = 8.12$, $p = .01$, $\eta p^2 = .35$. There was no significant difference between self (M = .34, SD = .48) and other (M = .40, SD = .35) source memory, $F(1, 14) = .73$, $p = .41$, $\eta p^2 = .05$ within the ADHD sample.

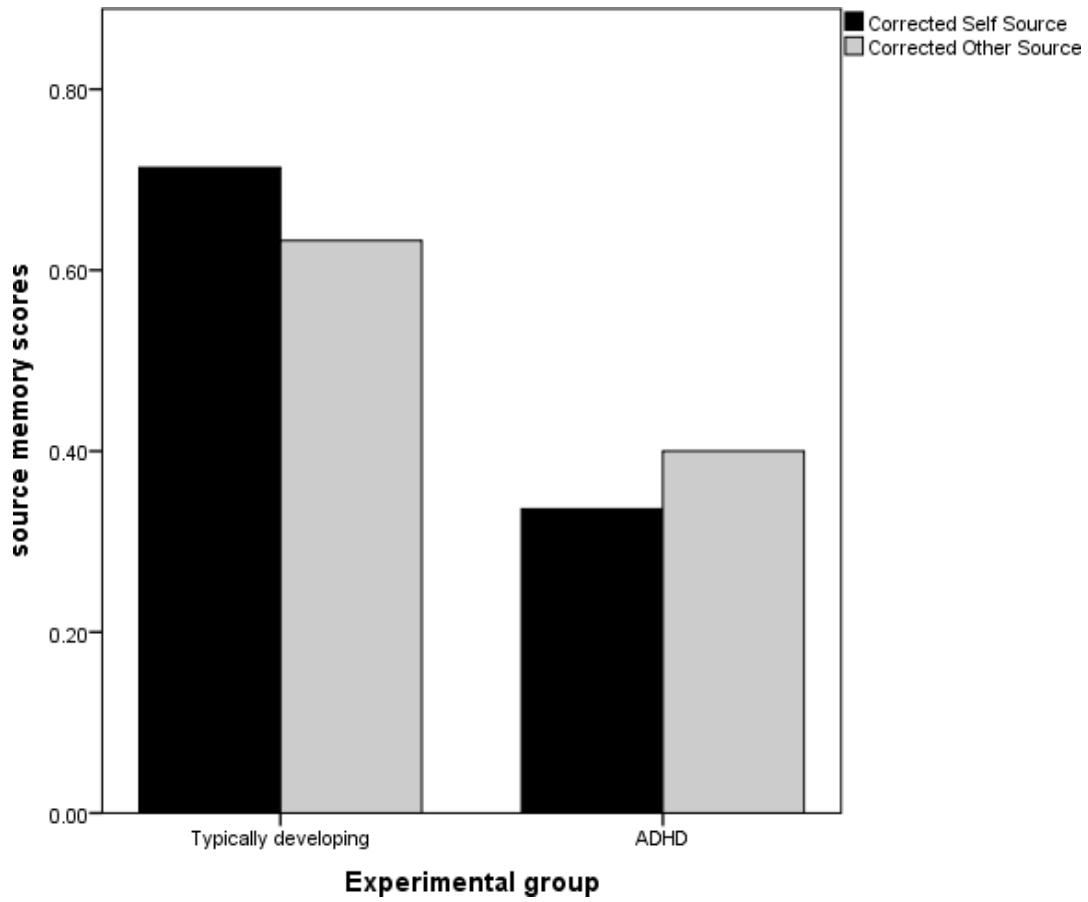

Figure 3. Bar graph depicting source memory scores for self and other encoded items within the typically developing and ADHD groups.

To explore the influence of chronological age, verbal age, performance IQ and attentional ability on source memory difference scores, correlational analysis was conducted (see Table 4). Source memory difference was calculated by subtracting other-referent memory scores from self-memory scores. The analysis revealed that no variables were significantly correlated with the source memory difference score.

Table 5: Correlation coefficients and the corresponding p values (in brackets) for the relationship between age in months, verbal age (BPVS score), performance IQ, attentional score (TEA-Ch), the self-performed action memory advantage score and source memory difference.

	Verbal age	Performance IQ	Attentional Scores	Source memory difference	SPT memory advantage score
Age (in months)	.57 ***(.00)***	-.23 (.23)	.32 (.10)	.03 (.88)	-.05 (.78)
Verbal age		.32 (.10)	.43 ***(.03)***	.29 (.13)	-.12 (.53)
Performance IQ			.55 ***(.00)***	.10 (.62)	-.06 (.78)
Attentional scores				.13 (.53)	-.10 (.59)
Source memory difference score					-.14 (.42)

3.2.2 Self-performed action task

A factorial ANOVA was conducted to compare the main effects and interaction of experimental group and referent on recall scores (see Table 4 for means). Experimental group included two levels (typically developing, ADHD) and referent consisted of two levels (self, other). The main effect for experimental group yielded an F ratio of $F(1, 29) = 1.07$, $p = .31$, , $\eta p^2 = .04$, indicating no significant difference between the typically developing group ($M = .50$, $SD = .02$) and the ADHD group ($M = .47$, $SD = .02$). The main effect for referent produced an F ratio of $F(1, 29) = 5{,}58$, $p = .03$, , $\eta p^2 = .12$, revealing a significant difference between self ($M = .57$, $SD = .04$) and other ($M = .40$, $SD = .04$) recall scores. The interaction was not statistically significant $F(1, 29) = .18$, $p = .68$, , $\eta p^2 = .01$. Next, a within-subjects ANOVA was conducted to compare recall for self and other performed actions in the SPT within the ADHD group alone. There was no significant difference in the scores for self-performed actions, $p = .32$, $\eta p^2 = .42$. To explore the impact of chronological age, verbal age, performance IQ and attentional ability on the SPT self memory advantage scores, correlational analyses were completed (see Table 5 for full output). As in Experiment 1, the SPT self memory advantage score was computed

by subtracting scores for other-performed actions from self-performed actions. There was no significant impact of variables on the self-performed action memory advantage.

Table 4. Means and standard deviations for self and other SPT recall scores

	Experimental Group			
	ADHD		Typically Developing	
	Self	Other	Self	Other
Mean	.54	.40	.60	.40
Standard deviation	.30	.28	.12	.12

3.2.3 Spelling task

Copying accuracy was high (97%) therefore all participants were included for subsequent analysis. A Shapiro-Wilk test of normality revealed that data for spelling accuracy was non-normal in both the experimental and control condition, $p < .05$. Additionally, data for description recall for the control group was non-normal, $p = .03$. A two-way ANCOVA was conducted to examine the difference between Experimental Group (Typically Developing, ADHD) and Spelling Condition (self-referent, other-referent) on sentence length, spelling accuracy and alien description recall while controlling for age in months (see Table 5 for means and standard deviations). Age significantly impacted sentence length, $F(1, 25) = 23.86$, $p < .001$, $\eta p^2 = .49$ and description recall, $F(1, 25), = 6.06$, $p = .02$, $\eta p^2 = .20$. There were no main effects of Experimental Group on sentence length, $F(1, 25) = 3.45$, $p = .08$, $\eta p^2 = .12$, spelling, $F(1, 25) = 1.171$, $p = .29$, $\eta p^2 = .05$ or description recall, $F(1, 25) = .07$, $p = .80$, $\eta p^2 = .00$. There were no main effects of spelling condition on sentence length $F(1, 25) = .43$, $p = .52$, $\eta p^2 = .02$, spelling accuracy $F(1, 25) = .01$, $p = .94$, $\eta p^2 = .00$, and description recall $F(1, 25) = .00$, $p = .96$, $\eta p^2 = 00$. There were no interactions for sentence length, $F(1, 25) =$

.00, $p = .99$, $\eta p^2 = .00$, spelling accuracy, $F(1, 25) = .95$, $p = .34$, $\eta p^2 = .04$ and description recall, $F(1, 25) = .01$, $p = .93$, $\eta p^2 = .00$.

Table 5 Means and standard deviations for Experimental Group and Spelling Conditions.

	Experimental Group							
	ADHD Spelling Condition				Typically Developing Spelling Condition			
	Self		Other		Self		Other	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Sentence length	6.36	3.17	6.11	1.37	7.76	3.06	7.31	1.84
Spelling accuracy	2.75	1.20	3.21	.72	3.62	.48	3.25	1.24
Description recall	1.93	2.35	2.00	1.52	2.13	1.96	2.21	1.49

Discussion

Experiment 2 examined self-referential processes within children with ADHD compared to a non-clinical matched control group. The efficacy of self-referential encoding methods within a spelling task among the groups was also investigated. The analysis revealed that the typically developing group had better source memory for self and other than the ADHD group. The typically developing group also showed significantly better recall for self source memory. As predicted, memory was higher for the typically developing group. However, the hypothesis that ADHD children would show an SRE in the cognitive self-referential task was not supported. Unlike the typically-developing children, there was no significant difference between mean scores for self- and other-items for children with ADHD and surprisingly, inspection of mean score revealed a trend in the opposite direction (I.e., higher number of source memory scores for other-items). Within previous studies, this pattern was observed among very young typically developing children (who also have low attentional capacity),

where four-year olds displayed an other-referent effect (Sui & Zhu, 2005). As discussed in section 1.2, Ross et al. (2011) argued that an advantage for other items can be due to the methodology utilised. Sui and Zhu (2005) placed a picture of the referent beside the to-be remembered object and found children under five showed a bias for other-referent items. However, interest in one's own photo may distract attention away from the corresponding item. To rectify this issue, Ross et al. (2011) placed the item's picture on top of the referent's picture, and their study was the first to reveal that children as young as three show a memory advantage for self-items. It would be worthwhile to use a similar design to test children with ADHD to better understand whether self-focus contributed to the results within the present study. Doing so would allow us to determine whether the trend towards an other-referent effect was due to the methodology used in which the referent and item to-be remembered were presented alongside each other rather than within the same visual field. The fact that this methodological change made a difference for the younger children suggests that when attentional resources are not well developed, this can reduce the likelihood of an SRE because self-referent cues may not be effectively bound to the item.

In further support of this proposal, previous research investigated the influence of attention at the time of encoding and the effect that this has on memory for self-referential items (Turk, Brady-van des Bos, Collard, Gillespie-Smith, Conway & Cunningham, 2013). The authors manipulated level of attention during an ownership paradigm task and discovered that memory for self-items was reduced when participants took part in a divided-attention test during encoding, whereas full attention lead to better recall for self-referent items. This finding further revealed the importance of attention in self-referential encoding, revealing that attention is a prerequisite for the elaborate representation of incoming self-related information. Therefore, as the cognitive self-referencing task may have affected attention

within the ADHD group with the use of two pictures presented simultaneously within different visual fields, this may in turn have affected encoding and therefore impacted memory. It is also important to highlight that a higher mean for other-referent source within the ADHD group was only observed in the corrected source scores and means for the false alarm rate for self was higher (implying self-interest again). Intriguingly uncorrected scores for self and other were almost identical. Further analysis using adapted methodology is therefore warranted to reduce the potential influence of self-focus.

Further support of additional research comes from the evidence in the SPT. The results revealed no difference in performance between groups, but reveal that overall the ADHD and typically developing group show a memory advantage for items performed by self. Additional analysis, conducted within the ADHD group alone, showed no statistical difference but the means trended towards a bias for self. As this may have been due to the issue of statistical power, exploring the SPT with a larger cohort could provide further insight into the clinical profile of ADHD. As there was a main effect of referent, and not group, it is suggestive that children with ADHD may have a similar developmental pattern of the self-construct as typically developing children, and proposes that they may benefit from similar cognitive advantages following self-referential encoding. Results from the evaluative self- referencing task, therefore, should not dismiss the presence of SRE processes within ADHD children. The results from the SPT further support the argument that an adapted evaluative self-referencing task should be administered to avoid possible interferences from self-focus. Alternatively, the difference in results following physical and cognitive self-referential encoding may be an indication of different development trajectories for the psychological and physical facets of the self within ADHD. As noted at the start of chapter 1, Lewis (1990) differentiated between the existential self the 'I' and the categorical self, the

‘me’. Previous research has noted the existential self may be intact, as demonstrated by the SPT, but the categorical self may be compromised (Klein & Laz, 2010) which would indicate an atypical development of the self-system among children with ADHD.

Prior to drawing conclusions on the developmental course in ADHD, it is important to note that the pattern of ADHD performance may be complicated because co-morbid Autism Spectrum Disorder (ASD) symptoms are common. Due to the wide range of Autistic traits the existence of SRE in the clinical group may be masked by differences among individuals. Autistic traits are commonly observed among individuals with a primary diagnosis of ADHD (Luteijn et al., 2000; Hattori, Ogino, Abiru, Nakona, Oka & Ohtsuka, 2006; Mulligan & Hoekstra, 2009) and this ranges from a varied estimate of 14% to 78% (Jang et al., 2013). The term 'autism' itself is derived from the Greek word 'auto' which translates to 'self'. Early theorists believed that individuals with the diagnoses were very focused on themselves (Bleuler, 1905) arguing that a major characteristic of the disorder is egocentrism. Today, however, this view has reversed and is believed to involve the absence of a self-concept (Frith, 2003) because of social and communication impairments. The mirror test, which has been used in typically developing children as a measure of self-awareness, reveals the emergence of self-conception from 18 to 24 months of age (Amsterdam, 1972). These results are comparable to early studies applying the mirror test to measure self-awareness in children with ASD (Neuman & Hill, 1978., Spiker & Ricks, 1984., Dawson & McKissick, 1984). However, as well as not controlling mental age which may have acted as a confounding variable, typical behaviours such as secondary emotions within these studies were not witnessed. As discussed in section 1.1, these emotions are indicative of self-consciousness. Neuman and Hill (1978) and Dawson and McKissick (1984) both discovered that despite passing the mirror test, behaviours were not comparable to

typically developing infants.

In line with this, it has been argued that children with ASD have an intact physical self-awareness but not a psychological one (Lind, 2010), meaning that they are aware of their physical being but have deficits in aspects such as beliefs and mental states. In a study by Henderson et al. (2009), typically developing participants and subjects diagnosed with higher functioning Autism were presented with a list of adjectives. They were asked to report whether the word was seven or more letters in length (to instigate featural level of encoding), if the word described Harry Potter or if the word described themselves. Out of the two groups, ASD participants failed to show any SRE. However, interestingly, the researchers found a negative correlation between the ASD symptoms and the SRE, in which participants with low functioning ASD symptoms showed less self-referencing biases. This suggests that, due to the broad nature of symptoms in ASD, the SRE may be present in this clinical group but individual differences need to be statistically controlled.

A significant main effect of referent and non-significant main effect of group was evident within the SPT and not the evaluative self-referencing task, further supporting the value of inspecting ASD traits. Several studies have discovered that children with ASD recall self-performed actions but have difficulty with verbal memory tasks (Summers & Craik, 1994; Wojcik, Allen, Brown & Souchay, 2011), which in in line with the argument that individuals with ASD have deficits in their psychological, but not physical, self (Lind, 2010). Thus, children with ADHD may display similar patterns, or the result within Experiment 2 may be due to the existence of ASD traits. Conversely, the finding may simply have been due to the influence of self-focus. Controlling ASD symptoms, as well as administering an adapted version of the evaluative self-referencing task will provide a clearer picture of the clinical profile and self-construct within children diagnosed with

ADHD.

Lastly, within Experiment 2, a spelling test was administered in which participants were randomly allocated to a self or other-referent condition. Unsurprisingly, age influenced the length of sentence as well as recall for alien description where an increase in age resulted in longer sentence production and better recall. However, age did not impact spelling accuracy, implying, as in Experiment 1, that the task may have not been difficult enough to test for an SRE. Typically developing and ADHD groups did not differ in their performance for sentence length, description recall or spelling accuracy. Moreover, the self and other-referent conditions did not differ on any of the spelling measures either. As data was non-normal, inspections of means revealed a ceiling effect. As a result, the usefulness of the SRE in educational tasks should not be dismissed. Rather, further analysis should be conducted with additional participants to improve statistical power and task difficulty should be increased to reduce the chance of a ceiling effect. In the present study, the same test was used for all primary school-aged children. As a spelling test which would be appropriate for all age and verbal levels was administered, this may have impacted results. The next step should be to use materials which are age and ability matched. This would better our understanding of the efficacy of SRE educational interventions. As presented in section 3.1.1, performance and verbal abilities was significantly different between the ADHD and typically developing group. This is another reason for why it is important to conduct further analysis, as performance between groups in the spelling task, under both self and other referent condition, was comparable and conflicts with the cognitive abilities difference between the ADHD and typically developing groups.

General discussion

Experiment 1 explored self-referential biases within a typically developing sample, as well as explore the efficacy of self-referential educational interventions. Experiment 2 extended this to compare a matched non-clinical sample from Experiment 1 with an ADHD group. The cognitive and physical self-referential encoding tasks within Experiment 1 provided intriguing results. There was a memory advantage for self-performed actions, as well as significantly higher source memory for self-referential objects. This supports previous findings (Ross et al., 2011; Cunningham et al., 2014). In relation to self- referential interventions within the educational task, inspections of means revealed a higher score for sentence length, spelling accuracy as well as alien description recall. Although there was no statistical difference between the self and other conditions, the means revealed a trend towards self-referential biases. The means, coupled with a lack of power and ceiling effect emphasise the importance of exploring this area further. The results of the educational task in the present study conflicted findings by Turk et al. (2015) in which it was discovered that sentence length and spelling accuracy was significantly better following self- referential encoding. Turk et al. (2015) applied the findings to a real-world context using actual words and tested children with spelling words appropriate for their spelling group level. This may rectify the limitation within the present study, in which a ceiling effect was observed. As there was a wide age group within the present study, choosing a test that was accommodating for all age levels may have masked any potential differences. Additional research, with the use of verbal-age matched words may provide a better understanding of the efficacy of self-referential learning interventions. It is important to accurately measure SRE as a tool for education, as the evidence of self-processes in typically developing children clearly illustrate the potential for real-world applications.

Experiment 2 compared self-referential processes within typically developing children and children with ADHD. Within the evaluative self-referencing task, differences for source memory were observed between the typically developing and ADHD samples. Inspections of means revealed a trend towards an other-referent effect among the clinical group. As discussed in section 3.2.1, it is important to carry out additional analysis, adapting the placement of stimuli to reduce any chances of self-focus which may affect the processing of accompanying visual information (Ross et al., 2011). Further support for this proposal is that within the SPT, memory for actions performed by self was recalled better over both groups than other-performed actions. This finding is intriguing, as it shows that both group's performance was similar and suggests that self-referential biases may be present within the ADHD sample. Thus, an adapted version of the evaluative self-referencing task may give a better insight into different levels of SRE processes within the clinical group.

Similar to findings from Experiment 1, the ADHD and typically developing groups did not show any differences in memory and engagement within the spelling task in either the self-referential or other-referent encoding condition. The groups differed in performance IQ and verbal ability yet performed comparably within the educational task. This supports the argument that SRE applications in education need to be further explored using tests matched to the child's cognitive ability. By increasing task difficulty and perhaps exploring other subject areas, such as mathematics and languages, we will have a broader and better understanding of the usefulness and flexibility of the SRE as an educational tool. As children with ADHD can face hindrances in education due to attentional and memory problems, it is essential to continue exploring the SRE as a potential tool to support engagement and memory, particularly after learning about memory advantage for self-actions. Results from

the present study, coupled with findings from Klein et al. (2011), suggest that the ADHD clinical group may cognitively benefit from self-referential processing. Klein et al. (2011) discovered that adult participants with ADHD displayed a significantly higher memory advantage following self-referential encoding than when information was processed semantically or structurally. The present study has intriguingly found that children with ADHD show a trend towards self-referential biases in self-performed actions, and displayed no difference in performance when compared with a typically developing group. These findings should therefore further motivate the exploration of real-world applications of the SRE as well as additional analysis of cognitive self-referential encoding.

However, as discussed in section 2.2.5, controlling ASD traits will update our basic understanding about the self-construct in ADHD. As the ADHD group showed a similar pattern as the typically developing group within the SPT, but not within the evaluative self-referencing task, this has several implications. Firstly, children with ADHD may display deficits in the psychological aspects of the self, as observed among children with ASD (Uddin, 2011), as well as previous research which suggested that the psychological self may be impaired in ADHD (Klein & Laxi, 2010). Ownership paradigms have regularly been used to assess the psychological self (Ross et al., 2011, Cunningham, Turk, Macdonald & Macrae, 2008). It has been argued that items which are owned by the self are evaluated in a more favourable light than items that are not owned. For example, if participants are asked to evaluate an object, they are likely to favour it more if they own it than when it is allocated to another participant, a phenomenon termed the endowment effect (Kahneman, Knetsch, & Thaler, 1991). Additionally, owned items are thought of as extensions of the self and easily integrated with the self-concept (Belk, 1988). Typically developing children, as young as three, show better memory for items owned by self than items owned by someone else

(Ross et al. 2011, Cunningham et al., 2008). As owning items has been used to assess the psychological self, Grisdale, Lind, Eacott and Williams (2014) explored the psychological self construct of ownership among typically developing adults and adults with ASD. The authors discovered that the typically developing group displayed an SRE for items owned by self, but the ASD group showed a similar recall pattern for both self and other items, but no SRE. Assessing self-referencing processes, whilst controlling for ASD traits, using an ownership paradigm may provide a valuable insight into the self-construct in ADHD to understand if both the psychological and physical self is intact. This update in knowledge will aid in the real-world applications of the SRE as well as gain a better understand of the clinical profile and development of children with ADHD.

Secondly, another implication is that the evaluative encoding task may have been executively challenging on children's memory within the ADHD sample. It has been argued that the SPT is non-strategic and results in the automatic formation of memories (Cohen, 1981), thus helping to avoid executive demands involved in the creation of memory representations. As ADHD involves deficits in memory and attention, processing demands rather than an atypical psychological self-concept may explain why a stronger trend towards the SRE was only observed within the SPT. As the self-referencing literature has demonstrated the importance of attention and its influence on memory (Turk et al., 2015), it is important to explore the SRE within ADHD using a self-referencing method which can strongly influence attention. Lastly, it is important to highlight that the false alarm rates for self within the evaluative task revealed that children with ADHD tended to incorrectly identify items as shown with their own picture, and there was a trend towards an other-referent effect. This implies that ADHD children may have tended to focus on the self both when guessing (as indicated by the false alarm rate) and possibly when processing

information (self-focus). As discussed in section 2.2.5, placing the referent's picture on the to-be- remembered item may help the encoding process by facilitating attention on the appropriate stimuli. This would provide a better measure of cognitive self-referential encoding among ADHD children.

Future research

As the study is the first to compare and demonstrate a similar pattern of memory for self-performed actions among typically developing children and children with ADHD, this finding paves the way for future research. Firstly, due to the problems encountered in assessing a cognitive SRE within the ADHD sample, the next step should be to control for ASD traits as well as apply a cognitive source memory test that will avoid the potential risk of self-focus. Additionally, applying the ownership paradigm would be particularly useful and relevant in nourishing our basic understanding of the psychological self in ADHD. Overall, these methods may aid in elucidating the extent of self- processing biases among this population. As there was a limited number of participants within the ADHD sample, yet a main effect of referent when comparing performance with a matched control sample it would be valuable to replicate the study with a larger cohort. As the means revealed a trend towards a self-bias it is important to follow-up on this difference with additional subjects. Regarding the applications of the SRE, future research should assess self-referential educational interventions using ability matched tasks. This could be carried out using material derived from school assignments. Doing so would avoid the risk of a ceiling effect, as observed in the present study, as well as provide a real- world approach of applying the SRE in education.

The current research, coupled with previous studies (Klein et al., 2011; Klein & Lax, 2010), provides possible evidence of a typical developing physical self-system in ADHD,

and this update in knowledge could aid in the development of tailored self-referential educational strategies. It has been proposed that a memory advantage resulting from the SPT may be instigated because of motor-encoding (Bäckman, 1985). Consequently, exploring the efficacy of self-referential educational interventions which incorporate motor movements would be of value. Within the areas of cognitive and social psychology, a vast amount of literature has focused on embodied cognition, suggesting that our motor system impacts our cognition just as our mind influences our body (Valeria, Thompson & Rosch, 1991; Gallagher, 2005; Gibbs, 2006) from as early as infancy (Piaget & Cook, 1952; Gibson & Pick, 2000). In a longitudinal study, Bornstein, Hahn and Suwalsky (2013) assessed five-month old infants' level of motor activity and exploration. Intellectual measures and academic achievements were then assessed at four, ten and fourteen years of age. Interestingly, motor activity was positively correlated with academic and intelligence scores. Although other variables may have predicted the pattern, the author suggested that infants who showed greater exploration and motor activity perhaps engaged with objects, others and the environment more thus contributing to their overall learning success.

An embodied cognition self-referencing framework therefore is of potential benefit for learning success in education. Interestingly, research has demonstrated benefits in language comprehension among children following the use of action in learning. By simply asking children to read sentences aloud and act out the events within the sentence with the use of objects, there was better understanding and recollection of information than a control group that was only instructed to read sentences (Glenberg, 2004; 2007). The author suggested physical enactment results in a richer representation, and therefore understanding, of context. Further support for active learning comes from studies in which

it was demonstrated that including movement into lessons, such as through associating actions with terms, and assigning body positions with to-be-learned concepts lead to an increase in engagement and facilitated interest among students (Hidi, 1990; Lindt & Miller, 2017). Given the evidence, it is important therefore to explore learning success following strategies which integrate movement and self-referential encoding. This is a simple, yet potentially valuable and inexpensive approach that could provide learning benefits to children, and particularly support children with an atypical developing self- system.

Conclusions

The present study yielded interesting findings which encourage additional examination of SRE processes within typically developing and ADHD samples using adapted methodology and a larger cohort. Specifically, self-referent memory advantages were found in typically developing children (Exp.1) and a main effect of referent (with higher scores for self) was found when comparing performance of children with ADHD and a matched control sample (Exp. 2) on a physical SRE task. Only typically developing children showed a self-advantage on an evaluative SRE task. The study is the first to assess and discover possible physical self-referential biases within ADHD children, which has improved our basic understanding of self-processes within this clinical group. This advancement in knowledge opens opportunities for the potential applications of the SRE in real-world contexts and further exploration of the self-construct.

Appendices

Appendix A: Research Ethics Application Form

This form has been designed to cover a wide variety of research studies. The sections you need to complete will be determined by the type of study you are proposing. Complete all sections as required and follow the instructions at the end of the form.

You must complete this form electronically – do not handwrite it.

Completed forms to be submitted via your School's Research Ethics Blackboard module.

Important: You must submit only one document. Should you need to submit anything in addition to the information requested in this form, please paste it at the end of this form as an appendix. If you have any questions about this form, please contact your school office.

A – Applicant Details – Everyone should complete this section.

A1	Name of Project Proposer	Zahra Ahmed
A2	Matriculation No.	[redacted]
A4	Name of Supervisor (where appropriate)	Dr Sheila Cunningham and Dr Josephine Ross
A5	Programme of Study	Masters by Research
A6	Module Code (where appropriate)	N/A

B – Project Details – Everyone should complete this section

B1	Project title: **Exploring the self-reference effect in children with Attention Deficit Hyperactivity Disorder (ADHD).**		
B2	Main aim of project: **To evaluate the prevalence of self-processing biases in children with ADHD and a typically developing control group, and the usefulness of applying the self-reference effect in an educational setting.**		
B3	Proposed start date: **10/16**	Proposed end date: **10/17**	
B4	Site of Research. *Where will this research take place?* **Abertay University**		
		YES	NO
B5	Is the proposed research based only upon reviewing existing **non-sensitive** literature? If YES, then your application will be expedited (i.e. approved without further scrutiny). ***Leave sections D—H blank and go directly to Section I.***		X

B6	Will you be accessing literature that could be deemed sensitive? If Yes, and your study **ONLY** involves Literature Review, **complete Section F and then progress to Section H.**		X
	Otherwise progress to Section C.		

Section C **External projects**

If your project is conducted fully or partly outside Abertay you may require approval from other ethical approval bodies.

If so, complete Section C, if not, progress to Section D.

C1	Name of external ethical approval body:	
C2	Application Status (chose one):	Approved Pending Declined
C3	Reference:	
C4	Date Submitted:	

Please note that, in the case where an application has to be made to an external ethical approval body, approval from both this body and the School's Research Ethics Committee are required.

Section D **Studies involving animals or biological samples of any type.**

If your study involves animals or biological samples **complete section D**,
otherwise progress to Section E.

		Yes	No
D1	Will the research involve **animals** of a type requiring a Home Office licence? *If yes, append a copy of the Home Office licence (or, in the case of a pending decision, append a copy of the Home Office application by pasting it at the end of this form. If you are yet to submit for a licence you acknowledge that you will not commence your study until you are in receipt of a licence).*		
D2	Will the research involve **genetic modification** (GM)? *If yes, append a copy of GMOC approval, (or, in the case of a pending decision, append a copy of the GMOC application by pasting it at the end of this form. If you are yet to submit for GMOC approval you acknowledge that you will not commence your study until you are in receipt of it).*		
D3	Will the research involve **stored human samples**, for example organs, tissues, cells (excluding established cell lines)? *If yes, explain in Section G how the human material will be employed and handled in accordance with the relevant legislation*		
D4	Does your study involve human participants? **If YES, complete Section E** **If NO, progress to Section G.**		

Section E **<u>Studies with Human Participants</u>**

If your study involves Human Participants **complete section E**, **otherwise progress to Section G.**

	Please confirm that:	YES	NO	NA
E1	I will describe the main experimental procedures to participants in advance, so that they are informed about what to expect?	✓		
E2	I will inform participants that their participation is voluntary?	✓		
E3	I will obtain explicit informed consent for participation, or assent in the case of questionnaire use?	✓		
E4	If the research is observational, I will ask participants for their consent to being observed?			✓
E5	I will tell participants that they may withdraw from the research at any time and for any reason?	✓		
E6	With questionnaires I will give participants the option of omitting questions they do not want to answer?	✓		
E7	I will tell participants their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs unless they explicitly consent to be identified.	✓		
E8	I will debrief participants at the end of their participation (i.e. give them a brief explanation of the study)?	✓		

E9	I will **NOT** deliberately mislead participants in any way? *Tick to agree*	✓
E10	My study will **NOT** involve a realistic risk of participants or researchers experiencing either physical or psychological distress or discomfort *Tick to agree*	✓

If you have ticked No to any statement you must ensure that the reasons for this are made explicit in Section G.

			Yes	**No**
E11	Do participants fall into any of the following groups**? If they do, refer to professional body guidelines and include some reference to these in Section G.**	Children (under 16 years of age)	✓	
		Schoolchildren of all ages	✓	
		Any person who may have difficulty understanding information provided to them		✓
		Patients		✓
		People in custody		✓
		People engaged in illegal activities (e.g. drug taking)		✓
		Other vulnerable group. Describe: Children with ADHD	✓	

If you have completed Section E, progress to Section G

Section F **<u>Studies NOT involving human or animal participants or samples.</u>**

Only complete this Section if your study does <u>NOT</u> involve human or animal samples or participants.

Please describe briefly how you would plan to execute your project, giving details of your proposed methodology, and then progress to Section H.

Section G **Details of Proposed Research**

G1	**Aims of study and Rationale:** *Provide an overview of why the research is being suggested, what the researchers aim to achieve, and what impact this may have. Write this as a summary for non-expert readers.*

There is a general consensus in the psychological literature that thinking about oneself while encoding information (known as self-referencing), results in better recall than information that has less self-relevance. Memory advantage related with self-referencing is known as the self-reference effect (SRE). For example, memory for trait words such as 'intelligent', will produce better recall if it was previously related to the self (e.g. by asking the participant, 'are you intelligent?'), than if it were related to another person (e.g., 'is John intelligent?') or if processed non-socially ('is the word intelligent capitalised or written in lower case?'). This effect has regularly been examined among adults and teenagers. On the other hand, the process of the SRE across childhood (i.e. before 10 years of age) is still unclear. In order to tackle this, research within the current project has utilised age-appropriate SRE measures for children ranging from the ages of 3 to 10 years.

Importantly, the SRE has the potential for impact in the real world. For example, recent research, using a typically developing group of school-aged children, demonstrated that there was improved performance in tasks such as spelling following the employment of self-referencing strategies. This is because self-referencing approaches increased engagement and supporting memory. As a result, it is evident that self-processing biases have a strong potential to provide educational learning strategies. The SRE paradigm may also be applied to clinical groups. Recent research evaluating the SRE in young adults with ADHD produced results that consequently suggest that there is a strong likelihood that SRE will also facilitate memory in children with ADHD. However, no studies till date have attempted to examine self-reference effects among children with ADHD. This population faces difficulties with memory and attention and consequently may benefit from self-referencing approaches. There is also a potential influence of co-morbid conditions such as ASD symptoms, which can affect self-processing. It is therefore important to evaluate the prevalence of self-processing biases in children with ADHD, and assess its effectiveness in providing an educational intervention to support learning.

The current research aims to achieve a greater understanding of SRE processes in young children, both typically developing children and children diagnosed with ADHD. Moreover, the usefulness of the SRE for educational interventions will be examined. This can have a very positive impact, as the self-reference paradigm is simple, yet effective, and could easily be applied in schools, and even by parents and/or carers, to support educational learning.

G2	**External Partners:** *List any organisations or partner groups to be involved in the proposed project.*

Leverhulme Trust (Funding body)
Dundee University (Dr Josephine Ross, Co-investigator on Leverhulme grant)
Dundee & Angus ADHD support group

G3	**Expertise:** *Where appropriate make a statement about the qualifications/expertise of the researcher (or planned training). For example, if the researcher is providing counselling, using clinical psychometrics, taking blood, working with samples, working with vulnerable groups etc.*
The supervisors are very experienced in delivering SRE test to children of all ages, and will train the researcher thoroughly before testing commences. Dr Sinead Rhodes (Strathclyde University) is also providing support and advice on testing children with ADHD.	

	Method:
G4	***Participants*** *State the number of participants you intend to recruit. Provide a description of the participants, including recruitment methods, age, exclusion/inclusion criteria, and any other relevant demographic information.* Given the lack of data for children diagnosed with ADHD, main priority in the current research is to evaluate the SRE in this population (*N* = 40; age range 6 to 11 years), and comparing this to a control group (*N* = 40) matched on gender and age. Given the clinical profile of ADHD, it is likely that the majority of the sample will be male. Participants with ADHD will be recruited through Dundee & Angus ADHD Support Group. Typically-developing (TD) children will be recruited through a local primary school, following consent from Dundee City Council, the head teacher and parents. Parents will be asked to provide informed consent for their child to participate in the study, and to complete a questionnaire regarding their child's ADHD symptoms and ASD-type traits (comprising the Conners (Parents) test, Strengths and Difficulties questionnaire, Social Communication questionnaire and Asperger's Syndrome Diagnostic Scale - see Appendix 1) and provide a postcode in order that we can estimate socio-economic status). With parental and council consent, the teachers of recruited children will also be contacted and asked to complete an ADHD symptom questionnaire (the Conners (Teachers) test - see Appendix 2). Children with a history of intellectual disability, seizures, traumatic brain injury or other neurological illnesses will be excluded from participation. Children taking psychotropic medications other than stimulant medication will be excluded from participation and all children taking stimulant medication will be asked to withhold medication for 24 hours prior to testing, consistent with standard research practices.
G5	***Materials &/or apparatus*** *Describe the materials & apparatus that you need to conduct your study. You should name any specific tests, questionnaires, etc. that you are using. If conducting interviews either an indicative list of questions or themes that will be discussed must be provided.* **A) Children's tasks** Children's tasks will be completed over two sessions. Parent and teacher questionnaires will be issued to be returned by the second testing session. Spelling task: Children will be tested individually in school (TD children) or at their support

group centre (children with ADHD) by a single experimenter. The child will be taken to a quiet area and asked to complete a spelling task adapted from Turk, Gillespie-Smith, Krisgolson, Havard, Conway and Cunningham (2014). This task involves using 4 syllable nonsense words presented as names of green aliens (Arror, Genful, Winead & Swarty). For the purpose of a neutral other–referent a red alien named Splay is also included. Pictures of the aliens will be shown in a workbook, and participants will be asked to copy down the names of the aliens then practice the name spelling by writing a sentence regarding each alien in which either they or Splay is the subject. On completion of the sentences, the experimenter will read out the names of each alien and participants will be asked to write down the names. This task will take ten minutes.

Maths task: The child will then complete a three-minute computerized maths task on a laptop, consisting of sums to 20. Participants will be asked to answer 32 questions (16 self-referent, 16 other-referent). In the self-referent condition, the math's questions will include the word 'you' and in the other-referent condition it will include another name, e.g. "John has three apples..".

Photograph: The child will have his/her photograph taken with a digital camera for use in the SRE task.

SRE task: The child will be asked to complete Cunningham et al.'s (2014) evaluative self-referencing task. This is a ten-minute computer-based task in which children are presented with 48 object images in a self-referent (own face) or other-referent (face of another participant) context. Familiar items such as toys and household items will be displayed. These will be presented alongside a picture of the child themselves or other-referent and the participant will be asked to indicate whether they think the person displayed would or would not like each object presented. In order to test recognition and source memory for the images the pictures will be displayed again to the participants.

Self-Performed Action Task (Ross et al, 2011): Participants will be presented with 24 cards each depicting an action (e.g., clapping hands). Half the actions will be performed by the participant and half by the experimenter. Recall and source memory for the images will then be tested.

Verbal and non-verbal task**:** To provide a measure of verbal and non-verbal ability, the child will complete two short tasks from the online NIH toolbox measuring receptive vocabulary and visuo-spatial processing. These take the form of online games and take two minutes to complete.

TEACh tasks: To provide a measure of attentional capacity, the child will complete three sub-tests of the Tests of Everyday Attention for Children (TEACh). A one-minute sustained attention task in which they circle symbols on a map, a two-minute counting forwards and backwards task, and a two-minute inhibition task (saying '2' when they read a '1', and vice versa).

B) Parent/Teacher tasks

Parents of children with ADHD will be asked verbally about where and when their child was diagnosed during Session 2. All parents will also be asked to complete the Conners (Parents) test, Strengths and Difficulties questionnaire, Social Communication questionnaire and Asperger's Syndrome Diagnostic Scale (see Appendix 1). The instructions to the questionnaire pack reassures parents that the tests are not diagnostic and they can miss out any questions they would prefer not to answer.

Parents of children with ADHD will also be asked to give the child's teacher an ADHD symptom questionnaire (the Conners (Teachers) test (Appendix 2). The teachers of the TD children will be given this questionnaire directly.

G6	***Procedure*** *Fully describe each stage of how your proposed study will be carried out*. Remember to list your chosen methodology or methodologies. Both typically-developing children and those with ADHD will be seen twice. For recruitment, TD children will have parent information sheets and consent form (Appendix 3) and questionnaires (Appendix 1) sent home as a pack. Children whose parents return a signed consent form and questionnaire will be tested. If more children return the forms than are required to complete the control group, the children to be tested will be chosen at random from the class register. For the children with ADHD, recruitment will be achieved with the help of the Dundee & Angus ADHD support group. A poster will be displayed at the centre to raise awareness of the study before parents with children in the appropriate age range are given the parent information sheet and consent form (Appendix 4) and parent questionnaires (Appendix 1). All children whose parents return the consent form will be tested. **Session 1** Children will be tested individually in school (TD children) or at their support group centre (children with ADHD) by a single experimenter. The child will be taken to a quiet area and asked to complete the spelling task and maths task, and have their photograph taken. Children with ADHD will be given a questionnaire for their teacher to complete, to be returned at the second session or posted to the researcher. At the end of session 1, the researcher will discuss Session 2 with the parents of children with ADHD (reiterating information already presented in the information sheet). They will be asked if the child can avoid taking their medication for 24hrs after school on a Friday, and be tested at home or at the University on the weekend, so that they can resume their medication before returning to school on Monday. If the parent is comfortable with this step, the parent will be asked to provide an email address or contact telephone number so that the researcher can make and confirm an appointment for Session 2. They will be asked to return the questionnaires at session 2. If the parent does not want to go ahead with the second session, their child will finish the study after session 1. These parents will be given a pre-paid envelope in which to return the questionnaires to the researcher at the University. **Session 2** TD children will be tested individually in school on the SRE, self-performed action, verbal and nonverbal NIH tasks, and TEACh tasks. Children with ADHD will be tested on the same tasks individually in their homes or a University lab space (depending on parental preference). At the end of the testing session, participants will be thanks and debriefed and their digital photographs will be deleted.

Appendices
Where available, please attach all other relevant documentation required for this study as an Appendix to this form. For example: participant information sheets, informed consent forms, questionnaires, interview schedules.

Progress to Section H

Section H – Ethical Issues

What ethical issues (if any) does your project raise? How will you mitigate against these ethical issues? **Do not** leave this section blank; if you are certain that there are no ethical concerns with this research, then you must explicitly justify this here.
(See "Ethics: a Quick Guide" for guidance on potential ethical concerns.)

H1	The researcher will have a PVG check before testing begins, and permission will be sought from Dundee City Council, the participating schools and parents. All participating children will also be asked to verbally assent before testing. The ADHD support group has already provided permission and is happy to support the project. For session 2, we are asking any children who are on medication not to take their usual dose for 24hrs before testing. For this reason, session 2 will always take place at a weekend or during a school holiday. The medication is relatively fast-acting so children can take their normal dose before going back to school. This is standard procedure for ADHD research and does not pose a medical risk to the child. Any parent who would prefer their child not to avoid medication can withdraw their child before session 2. As a result of the requirement to test the children un-medicated, session 2 may take place in the child's own home (if the parent would prefer not to bring the child to the University). A full risk assessment will be carried out before this testing takes place and the researcher will be advised on safe procedures for testing in a private space. All parents will be fully involved in the ADHD support group so will not be strangers to the researcher when testing takes place.

Progress to Section I

Section I Confirmation/Declaration

Place an X in each box to confirm you agree with the statement.

	Yes
I am aware I need to submit a Risk Assessment and will do so before commencing the proposed study. (Note: you must follow whatever procedures your School has in place for the review and approval of risk assessment. Seek advice from your supervisor). **Note, all studies except Literature Reviews must complete an appropriate risk assessment prior to commencing the study.**	X
I have read and understood Abertay University's policy on research ethics ("Ethics: a Quick Guide"), the Abertay University Health and Safety Policy, and any equivalent School Policy.	X
For each working location (including university facilities and home), I will identify what to do and who to contact in case of emergency, and will make myself aware of any existing safety, First Aid or emergency procedures.	X
Any data collected from experiments will be stored securely within a week in Abertay University facilities following the guidance set out in the University's Data Storage Policy.	X
I understand that it is my responsibility to ensure compliance with any relevant regulatory or legal requirements (such as data protection legislation, stored tissue regulations, animal experimentation licensing, etc).	X
The proposed study will not discriminate against participants on the grounds of race, sex, religion or belief, sexual orientation, disability, pregnancy and maternity, gender reassignment, marriage and civil partnership, and/or age.	**X**
I have completed all sections of this form fully and accurately	X
I understand that should I receive a Conditional Approval, I will need to comply with the Conditions set out in the Decision email.	**X**
I understand that should I receive a Rejection, I will not be permitted to conduct any work on my proposed project. In such circumstances I will meet with my supervisor to discuss submitting an alternative proposal or one that addresses all the concerns raised in the review.	**X**
I understand that should I subsequently amend my study after approval has been given I will be required to inform the ethics committee of the change, and that changes that materially affect the study may require a further submission for ethical approval.	**X**

If you are an **undergraduate or postgraduate student**, please also confirm that:

	Yes

My supervisor (as named in A4) has read and approved this completed form.	X
My supervisor will approve any materials that I provide to human participants before use (e.g. consent forms, questionnaires, interview questions).	X

Paste any extra information here.

What to do next

Having checked that you have fully completed this form submit it in electronic form to the School Research Ethics Blackboard page.

Remember, you must submit only one document. Any information you wish to submit as part of your proposal other than that requested above can be cut and paste below.

Type of Study:	Complete Sections:								
	A: Applicant details	B: Project details	C: External projects	D: Studies involving animals or biological samples	E: Studies with Human Participants	F: Studies **NOT** involving human participants or biological samples	G: Research Proposal	H: Ethical Issues	I: Confirmation/Declaration
Non-sensitive Literature Review only.	✓	✓							✓
Potentially sensitive Literature Review only.	✓	✓				✓		✓	✓
Study includes biological samples but **not** human participants.	✓	✓		✓			✓	✓	✓
Study does **not** include animals or biological samples or human participants.	✓	✓				✓		✓	✓
Study does not include animals or biological samples but **does** involve human participants.	✓	✓			✓		✓	✓	✓
Study includes biological samples **and** human participants.	✓	✓		✓	✓		✓	✓	✓
Study includes animals but **no** human participants.	✓	✓		✓			✓	✓	✓
Study includes animals **and** human participants.	✓	✓		✓	✓		✓	✓	✓

Appendix B: Typically developing group information letter and consent form

INFORMATION LETTER

Dear Parent/Guardian

My name is Zahra Ahmed and I am a Masters by Research student at Abertay University. I am currently supporting a research project called 'Exploring the self-reference effect in children', supervised by Dr Sheila Cunningham (Abertay University) and Dr Josephine Ross (University of Dundee). I would like to invite your child to participate. The purpose of this letter is to provide you with information regarding the project.

It has been shown that thinking about oneself while encoding information (known as self-referencing) improves memory for that information. This memory advantage is known as the 'self-reference effect' (SRE), and is well-established in children. The purpose of the current study is to test whether children of different abilities benefit equally from interventions that use self-referencing to improve memory. In particular, we will be examining whether interventions help children both with and without a diagnosis of ADHD. Individuals with ADHD can face problems with attention and memory, therefore it is vital for us to test strategies that may benefit their learning.

Children who take part in the research will complete simple tasks over one or two sessions. During the initial, 15-minute session in the support group, the child will be asked to complete a maths and spelling task, and have their photograph taken digitally. The child's participation can end after this session.

If your child is un-medicated or you would allow your child to avoid taking their medication for 24hrs (e.g., from Friday after school), he or she can take part in a second session at a weekend. In this second session, children's memory for objects presented with their own or another child's photograph will be tested, alongside their memory for actions performed by themselves and the experimenter (e.g., clapping hands), and their performance on a short verbal and non-verbal computer game. Lastly, children's level of attention will be measured using three tasks presented as games in a magazine. These involve circling symbols on a map, and counting forwards and backwards along a chain. At the end of the second session, the child's digital photograph will be deleted.

So that we can look at the behavioural differences that may underlie the performance of children with and without ADHD, we are also asking parents to complete the attached questionnaire.

I would be most grateful if you would allow your child to participate in the research. Although the results may be published in an academic journal, any data collected from your child will be anonymised and confidential. It does not form part of any formal assessment that may be carried out by the school. You or your child are free to withdraw from the study at any time, without providing a reason for your withdrawal. Please note that I have undergone full Disclosure Scotland checks prior to sending this letter.

If you would like your child to take part in the project, please sign the attached form and fill out the questionnaire. Once completed, please place the forms in one of the prepaid and addressed envelopes. You may post these or hand them in at the support group for me to collect. I will be happy to answer any questions that you may have, please feel free to contact me either by email on [redacted]@uad.ac.uk or by telephone on (01382) [redacted].

Yours sincerely

Zahra Ahmed

Consent form

Exploring the self-reference effect in children

If you are happy for your child to participate in the above study, please insert your name and sign below where indicated. Please return the form and attached questionnaire by **21st April 2017.**

I _____ (NAME PARENT/ GAURDIAN) give consent for my child - _____ (CHILD'S NAME) in class_____(e.g. P2a) to participate in above-named study conducted by Zahra Ahmed.

Parent/Guardian's signature: _____

Date: _____

If you agree to your child avoiding medication for 24hrs at a weekend, and you are happy for him or her to take part in the second testing session, please complete the additional details below:

Email address OR contact telephone number:_____

Child's normal medication (please indicate name and dose/frequency):
_____

Appendix C: ADHD group information letter and consent form

Exploring attention and memory in children with ADHD

When information is related to ourselves (e.g., our own face or name), then it attracts attention and is stored effectively in memory. We have found that this 'self-effect' can be useful in education - for example, asking children to think about themselves while learning new information helps to attract attention and learn the new information better. We are now testing whether these self-tasks are useful for children with ADHD.

We are testing a number of self-tasks on children who have ADHD, and those who do not. One task involves maths problem solving, one is a spelling task, and there are two memory tasks. We will compare how children with and without ADHD do on these tasks. We expect that because self-tasks attract attention, these tasks should help to bring children with ADHD to do as well as those without any attentional problems.

For further information please see attached the information sheet.

If you have any questions please feel free to contact me either by email on [redacted]@uad.ac.uk or by telephone on (01382) [redacted]

INFORMATION SHEET

Study of attention and memory in children with ADHD

INVITATION TO TAKE PART IN A RESEARCH STUDY

Your child is being asked to take part in a research study by Zahra Ahmed (Masters by Research student, Abertay University) and supervised by Dr Sheila Cunningham (Abertay University) and Dr Josephine Ross (University of Dundee).

WHY WE ARE DOING THIS STUDY

When information is related to ourselves (e.g., our own face or name), then it attracts attention and is stored effectively in memory. We have found that this 'self-effect' can be useful in education - for example, asking children to think about themselves while learning new information helps to attract attention and learn the new information better. We are now testing whether these self-tasks are useful for children with ADHD.

TESTING METHOD

We are testing a number of self-tasks. One task involves maths problem solving, one is a spelling task, and there are two memory tasks. We will compare how children with and without ADHD do on these tasks. We expect that because self-tasks attract attention, these tasks should help to bring children with ADHD to do as well as those without any attentional problems. At the end of the session, the child's photograph will be deleted.

So that we can look at the behavioural differences that may affect school work in children with and without ADHD, we are also kindly asking parents to complete the attached questionnaire.

TIME

Testing can take place at the support group or at the child's home, depending on the parent's preference. There is a total of three sessions, lasting no more than twenty minutes each.

REWARD
Your name will be included in a prize draw for a £25 Amazon voucher.

RISKS
There are no known risks in this study.

ENDING PARTICIPATION
You and/or your child may decide to stop being a part of the research study at any time without explanation.

CONFIDENTIALITY/ANONYMITY
Although the results may be published in an academic journal, any data collected from your child will be anonymised and confidential.

FOR MORE INFORMATION ABOUT THIS RESEARCH STUDY
If you would like your child to take part in the project, please sign the attached form and fill out the questionnaire. Once completed, please place the documents in one of the prepaid envelopes. You may post these or hand them in at the support group for me to collect. I will be happy to answer any questions that you may have, please feel free to contact me either by email on [redacted]@uad.ac.uk or by telephone on (01382) [redacted].

The School of Social and Health Sciences Research Ethics Committee of Abertay University has reviewed and approved this research study.

CONSENT FORM

Exploring the self-reference effect in children

If you are happy for your child to participate in the above study, please insert your name and sign below where indicated. Please return the form and attached questionnaire to the researcher or support group workers within 1 week.

I _____ (NAME PARENT/ GUARDIAN) give consent for my child - _____ (CHILD'S NAME) to participate in above-named study conducted by Zahra Ahmed.

Email address OR contact telephone number:_____

Child's normal medication (please indicate name and dose/frequency):

_____

Parent/Guardian's signature: _____

Date: _____

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